# NASA Contractor Report 3676



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# The COREL and W12SC3 Computer Programs for Supersonic Wing Design and Analysis

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## SUMMARY

This report contains a description of two computer codes useful in the aerodynamic design of wings for supersonic maneuvering. The codes are not restricted to the supersonic maneuvering case however, and should be valuable in a wide variety of applications. The nonlinear full potential equation COREL code performs an analysis of a spanwise section of the wing in the crossflow plane by assuming conical flow over the section. A subsequent correction to the solution can be made in order to account for nonconical effects. The flowfield is assumed to be irrotational (Mach numbers normal to shock waves less than about 1.3), and the full potential equation is solved to obtain detailed information on the leading edge expansion, supercritical crossflow, and any crossflow shockwaves. W12SC3 is a linear theory panel method which combines and extends elements of several of Woodward's codes for the particular case of fighter applications. After a brief review of the aerodynamic theory used by each method, the use of the codes is illustrated with several examples, detailed input instructions, and a sample case.

## INTRODUCTION

The "standard" computational methodology used for the aerodynamic design of efficient supersonic wings is based entirely on linear theory and is primarily intended for supersonic transport applications. A summary of that methodology has been given by Miller, et al, in Ref. 1. Typically, fighter aircraft design presents situations in which many of the assumptions of linear theory are no

longer valid. These include higher lift coefficients, lower wing sweeps, and round leading edges. A more thorough discussion of the problem is contained in Ref. 2. In particular, the two codes described in this report were developed as tools for the aerodynamic design of wings employing the Super Critical Conical Camber concept* ($SC^3$). $SC^3$ is a wing concept for supersonic maneuvering through which high supersonic lift coefficients are obtained. This is accomplished by controlling the crossflow development such that the expansion around the leading edge becomes supercritical without generating adverse pressure gradients of sufficient strength to separate the boundary layer. The concept is achieved primarily by a conical cambering of the wing surface and is described in more detail in Ref. 3.

The baseline codes for the computer programs described in this report were not written by the authors. However, extensive modifications to these codes were made by the authors and their co-workers at Grumman. In particular, the fully nonlinear conical flow "COREL" method, Ref. 4, was written in the Grumman Research Department by Bernard Grossman, and the linear nonconical "W12SC3" method is based on the so-called "Woodward II" code, Ref. 5. In addition, the COREL code makes use of the Craidon surface patch program, Ref. 6, as modified by Mike Siclari of the Grumman Research Department to obtain spanwise geometry directly. The details of this extension are described in Ref. 7. The W12SC3 program is a modification of the USSAERO program, Ref. 8, and has the capability to perform a number of calculations not available in that program. In addition to the standard complete analysis capability, W12SC3 can treat: full design and optimization; mixed design-analysis and design-optimization (including a conical panel capability); and a local correction to linear supersonic theory wing calculations, the Carlson Correction, Ref. 11. It also has the capability to calculate wing-on-body effects using an interference shell placed around the body rather than on the body itself. Many of these options use methods similar to the original "Woodward-I" analysis and design code (Ref. 9). In addition to the work by the authors, important contributions to the W12SC3 code were also made by A. Cenko

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*Note that the linear theory code, W12SC3, retains all the "normal" options available in the baseline code.

and J. Malone. A key feature of the two methods is the use of the Craidon geometry program input, Ref. 12, to define geometry for both computer programs.

This report contains a brief review of the aerodynamic theory used by both codes, followed by a number of examples and some comments on the use of the methods in aerodynamic design. Subsequent sections provide a description of the computer programs, computer requirements for running the codes, detailed input descriptions, and a sample case.

## REVIEW OF THE AERODYNAMIC THEORY

The details of the methods are contained in the references. However, a brief overview of the aerodynamic theory is presented here in order to summarize and emphasize the assumptions employed.

### COREL Program

The important nonlinear and mixed subsonic/supersonic crossflow that develops on supersonic wings at high lift coefficients is computed using the COREL code developed by B. Grossman, Ref. 4. The method computes the flowfield about a given spanwise section by assuming that the geometry passing through the specified section is conical. The results obtained using this approximation can then be adjusted to account for the actual (nonconical) geometry. The flowfield is assumed to be represented by the potential flow equation, which is a good approximation as long as the Mach number normal to the shock waves is less than about 1.3.

Under the stated assumptions, the calculation becomes similar to the 2-D transonic problem - and most of the recent advances in transonic computational fluid dynamics are directly applicable. Therefore, COREL solves the problem by a finite-difference formulation in which the bow and crossflow shocks are captured as part of the solution. Other distinguishing characteristics are the use of a nonconservative form of the finite-difference equations and the sequence of mappings transforming the problem from the physical domain to the computational domain. In COREL a single Joukowski transformation is used for the wing, so that

the wing becomes an exact coordinate surface only for the case of uncambered circular or elliptic spanwise sections.

This particular version of the code includes improvements over the published description, Ref. 4. The most significant improvement is the use of an initial solution obtained on a crude grid to estimate the bow shock position, followed by a re-mapping using the computed bow shock location. This reduces the importance of the initial bow shock estimate and improves the convergence of the method. A second major refinement is the use of an analytic expression for the singular part of the mapping metric rather than the use of finite-difference formulas to find the metric gradients (which can be nearly singular). Finally, the program has been generalized to allow for relaxation sweeps to be made partly in the ring direction and partly in the column direction (see computer requirement for an explaination of terminology). This allows some cases to run which would not converge previously.

The spanwise section analyzed in COREL can either be specifically input or extracted from the Craidon geometry data set, Ref. 6. The Craidon geometry section comes from the Siclari program, Ref. 7, for wing analysis. This code is a modification of the Craidon program, Ref. 6, so that the section shape can be obtained at arbitrary locations and requires the solution of the surface patch equations by a Newton iteration. The surface patch program can also be used to obtain the difference between the true streamwise slope of the surface and the streamwise slope of a conical surface with the same spanwise section. This slope increment can then be used to make a correction to the pressure coefficient to approximate the pressures on the actual nonconical geometry.

## W12SC3 Program

The panel method program used for calculating the linear theory estimate of the aerodynamics of the configuration is based on the Woodward codes (Ref. 5 and 9). Although the most useful elements of both codes have been combined together with a number of additional features, the baseline code for the development effort was the Woodward B-00 code obtained from the NASA Langley Research Center in November 1976. The W12SC3 code consists of a combination of source and vortex

panel singularity distributions. The vortex singularities are distributed in either a constant or a piecewise linear fashion streamwise and are piecewise-constant spanwise. The source singularities are constant on body panels and piecewise-linear streamwise on wing panels.

The W12SC3 code is a Grumman version of the Woodward II code developed for the $SC^3$ study and can be used to perform the following aerodynamic functions:

- Full Analysis
- Full Design
- Full Optimization
- Mixed Design-Analysis
- Mixed Design-Optimization.

The W12SC3 program applies linear theory panel methods to find the solutions for wing-body configurations. Wing-on-body effects are calculated on the arbitrary body model (as in Woodward II), or the user may specify that wing-on-body effects be calculated on an interference shell that approximates the actual body shape (as in Woodward I).

## W12SC3 Program Options

Reference 5 gives a detailed discussion of the aerodynamics methodology contained in W12SC3 and should be considered a primary reference for the new program. Certain differences do exist, however, between the aerodynamic singularity distributions used in W12SC3 and those used in Woodward II. During the execution of several W12SC3 options, the linearly varying vortex panels used exclusively in Woodward II are replaced by constant-strength vortex panels. When this occurs, no extra singularities are used at supersonic trailing edges and control point locations are fixed at 95% panel chord (85% for subsonic Mach numbers). These changes are necessary for implementing the design and optimization options (see Ref. 10) and for cases where wing-on-body effects are calculated on an interference shell. In addition, constant-pressure panels improve analysis results for wings with supersonic leading edges. It should be emphasized, however, that the W12SC3 program can reproduce Woodward II pressure distributions when desired.

The final output of each of the new design and optimization options is a wing camber distribution. This camber distribution, together with wing thickness slopes, body shape, and aircraft angle-of-attack are used to calculate aero panel singularity strengths. The resulting vortex and source singularity distributions are then used to determine surface velocities and pressure coefficients.

The W12SC3 program can be used to calculate results for multiple Mach numbers. Each new Mach number is compared to the previous value to determine if a recalculation of the required aerodynamic influence matrices is necessary. Drag polar results can be obtained by utilizing the camber distribution from a previous cycle, requesting the previous Mach number but changing the aircraft angle-of-attack.

The five analysis, design, and optimization options available to the W12SC3 program user, as well as other features of the code, are briefly described below. For each of the following options, if a body is part of the configuration, body and wing-body interference effects are included in the calculations.

Full Analysis. - The program user specifies configuration geometry, Mach number, and aircraft angle-of-attack. The given camber distribution, thickness distributions, and aircraft attitude are used to determine surface velocities and pressures. A camber distribution generated during a previous design or optimization cycle can be used for this calculation.

Full Design. - The program user specifies configuration geometry, Mach number, and a lifting-pressure coefficient ($C_{p_{LOWER}} - C_{p_{UPPER}}$) distribution for all wing panels. The W12SC3 Program then calculates the wing camber distribution required to produce the input lifting-pressure coefficients.

Full Optimization. - The program user inputs configuration geometry, Mach number, and the type of loading constraint desired. The constraint can be either the wing lift coefficient $C_L$ or the wing $C_L$ and center of pressure, $X_{CP}$. The program then determines the wing camber distribution for minimum wing drag subject to the given constraints.

Mixed Design-Analysis. - The program user specifies configuration geometry, Mach number, and a lifting-pressure coefficient or camber-slope value for each wing panel. For panels where cambers are input, the input slope is assumed to be specified at the 95% box chord (85% for subsonic Mach numbers). The program will then determine the camber slopes where pressures were given, and pressures where camber slopes were given.

An additional $SC^3$ option will perform a conical mixed design-analysis. For this case:

1. A conical ray dividing the wing planform into a supercritical panel (outboard of the dividing ray) and a subcritical panel (inboard of the dividing ray) is defined.
2. At control points on the supercritical panel, pressures are prescribed according to a conical lifting-pressure distribution, $\Delta C_p$ vs $\eta$. These pressures may have been calculated by COREL (combined COREL/W12SC3 run) or supplied by the user (W12SC3 alone run).
3. At control points on the subcritical panel, camber-slopes are prescribed to be those the code would have used for a full analysis cycle or camber slopes that have replaced these slopes during a previous design or optimization cycle.
4. The code then determines camber-slopes where pressures were given, and pressures where camber-slopes were given.

Mixed Design-Optimization (constrained Wing Optimization). - The program user inputs configuration geometry, Mach number, and the wing $C_L$ (and $X_{CP}$) constraint(s) desired. In addition, the lifting-pressure coefficients on an arbitrary number of wing panels are specified. The program then determines the wing camber-slopes required to minimize wing drag subject to the given constraints. The program user has the option of minimizing drag on either the total wing planform or on the portion of the wing where pressures have not been specified.

An additional $SC^3$ option will perform a conical mixed design-optimization. This option is similar to the conical mixed-design-analysis option: wing camber-slopes at control points on the subcritical panel are determined so as to

minimize wing drag subject to the wing lift and moment constraints, as well as producing the specified conical lifting-pressure distribution at control points on the supercritical panel.

## Wing-on-Body Effects

Wing-body configurations may be modeled using one of two distinct methods:

1. Wing and body are paneled using source panels to account for the entire flow disturbance on the body (as in Woodward II), or
2. In addition to the wing and body source panel models, an interference shell that approximates the actual body shape is placed about the body (as in Woodward I). This constant cross-section shell model is comprised of planar vortex singularities similar to those on the wing. The wing-body interaction due to lift is then treated approximately by applying the boundary conditions on the interference shell rather than on the actual body surface. The interference shell is, in effect, another lifting surface and therefore the interference shell paneling can be also used to model additional nacelle, wing, or tail segments. However, the solution algorithm is structured such that these additional segments would be considered "body" parts, and thus their slopes are held constant during any design or optimization calculations. This additional flexibility could be quite useful for some cases.

## Control Point Locations

For linearly varying vortex singularities (full analysis only) the control point location and number of singularities along each wing chord are computed automatically by the program. The locations selected are dependent on the flight Mach number and the wing-streamwise-strip leading and trailing edge sweep angles (see Ref. 5, pages 43-45). If constant-pressure panels are specified (Woodward I type panels), the control point location is fixed at 95% of the box chord.

For most options, the W12SC3 program automatically selects Woodward I type vortex panels. This occurs if:

- Any option except full analysis is chosen, or
- The user inputs wing control-point camber-slopes, or
- Wing control point camber slopes from a preceding design or optimization cycle are used, or
- Interference shells are used.

## Determination of Singularity Strength

The original Woodward II Code utilizes iterative techniques to determine vortex and source singularity strengths. Four methods - blocked Jacobi, blocked Gauss-Seidel, blocked controlled successive overrelaxation, and blocked successive overrelaxation - are available for the full analysis case only. The W12SC3 program also provides a fifth solution technique which is based on inversion of the aerodynamic influence matrix (this is the only solution technique available for the full and mixed design and optimization options.) The blocked Jacobi and the matrix inversion methods are described in Ref. 5 and 9, respectively.

The matrix inversion technique would normally be used in analysis cases when the iterative methods fail to converge for a given set of boundary conditions. However, for drag polar calculations, the inversion technique can be more efficient than use of the iterative methods. This efficiency is, in part, a result of storing the required inverse aerodynamic matrix. For repeated Mach numbers, a new singularity distribution is obtained by a single matrix-multiplication step utilizing new boundary conditions.

## Camber Distributions

Camber distributions can be obtained by three methods within the W12SC3 Program.

The first type is a user-supplied mean camber-line distribution, given along two or more airfoil chords and referenced to the leading edge Z-height at each chord, as in the standard Craidon-type input, Ref. 6. After the wing paneling has been calculated, the mean camber-line surface is curve-fit using spline interpolation and a slope value is assigned to the leading and trailing edges of each panel.

The second type of camber distribution is also supplied by the program user. This optional data input consists of camber slopes, given one per panel, evaluated at each panel control point location.

The third type of camber distribution is calculated by the program during execution of the full and mixed design and optimization options. The resulting camber slopes are given at each panel control point.

When camber slopes are obtained as part of the solution, wing camber-shapes are determined as in Woodward I by integrating camber slopes along each airfoil chord.

## Pressure Distributions

Velocities and pressures are calculated at all wing, body, and interference shell control points. The Carlson Correction (a local correction to supersonic linear theory wing calculations) is applied at wing control points.

Panels are then assigned pressures. For linearly varying vortex panels, the pressures at 50% panel chord are found by interpolating between control points. For constant vortex panels, the control point pressures (pressures at 85% or 95% panel chord) are used.

The user may ask for wing spanwise pressure distributions at specified axial stations. These are found by streamwise interpolation between control points.

## Force and Moment Coefficients

Panel pressure coefficients are used to calculate values of normal force, axial force, and pitching moment about a reference point for each aero panel in the configuration model. Total lift, drag, and moment coefficients are then obtained by summing the appropriate force and moment components with respect to the freestream direction and normalizing the results with a user-supplied reference area. The panel inclination angles used for these calculations depend on the wing thickness slopes, wing camber slopes, and type of panel singularity.

Wing thickness slopes are presently evaluated at panel centroids, as in the case of the Woodward II program. For linear vortex panels, camber slopes are also evaluated at each panel centroid. For constant strength vortex panels, however, camber slopes at the 75% chord are used rather than the centroidal location. This change was made to improve drag predictions. The rationale is discussed fully in Ref. 9, pages 95-97.

Total force and moment coefficients are found for the body, the wing, and the interference shell, as well as for the full configuration. Wing and full-configuration values based on the Carlson Correction pressures are also calculated.

For mixed design-analysis and mixed design-optimization options, exposed wing (panels where pressures are not specified) forces are also calculated.

## Paneling Rules

The following rules should be followed when modeling configurations:

- A total of 1653 panels may be used to model all surfaces
  - 551 wing, fin, and canard panels
  - 551 shell and additional nacelle, wing, and canard panels
  - 551 body panels
- A total of 19 streamwise strips is allowed for all wing, fin, and canard panels
- The maximum number of panels in the streamwise direction is 29 on each wing, fin, or canard surface
- A total of 29 panels in the streamwise direction is allowed for all body segements
- The maximum number of panels used to model the body cross-section is 19 on each body segment
- A total of 19 streamwise strips is allowed for all interference shell and additional nacelle, wing, and canard surfaces
- The maximum number of panels in the streamwise direction is 29 on each interference shell and each additional nacelle, wing, and canard surface

- If utilizing iterative solution techniques, the number of panels on circumferential fuselage strips should be an integer factor of 60. This is not a rigid rule, however, and can be relaxed if matrix inversion is used as a solution method or if the iteration techniques converge in a reasonable number of cycles
- For design-optimization problems, a uniform wing paneling distribution should produce smoother results in most cases (see Ref. 10)
- For calculation of leading edge thrust from the computed pressure distribution, a nonuniform streamwise spacing is necessary with leading edge boxes on the order of $10^{-2}$ to $10^{-3}$ chord lengths. Spanwise cosine spacing will also improve results. A limited number of analyses indicate that constant-strength vortex panels (Woodward I panels) produce the most accurate results.

## TYPICAL APPLICATIONS OF THE PROGRAMS

The two programs each contain numerous options, and together they can be used to handle most of the problems that arise during supersonic wing design. Some examples illustrating how these codes are used and how the results can be expected to agree with experimental data are presented in this section.

The COREL code computes the pressure distribution over a specified spanwise section and thus the design evolves through repetitive submissions of the code, with the user modifying the spanwise sections based on the previous analysis results. An example of a typical starting point for design is shown in figure 1, which illustrates the COREL predictions for a symmetric section. The predictions for the expansion around the leading edge to supercritical crossflow levels, followed by a strong crossflow shock wave, agree well with the experimental data. These results are taken from Ref. 13. The result for a case in which the spanwise section has been carefully shaped to obtain high lift and reduce the crossflow shock wave is shown in figure 2, also extracted from Ref. 13. In both cases the geometry is purely conical. Typical results for the more representative case of nonconical geometry are given in figure 3. The wing was primarily designed using the equivalent conical section correction in COREL, together with the more general (and expensive) NCOREL method (Ref. 14). The experimental data are from

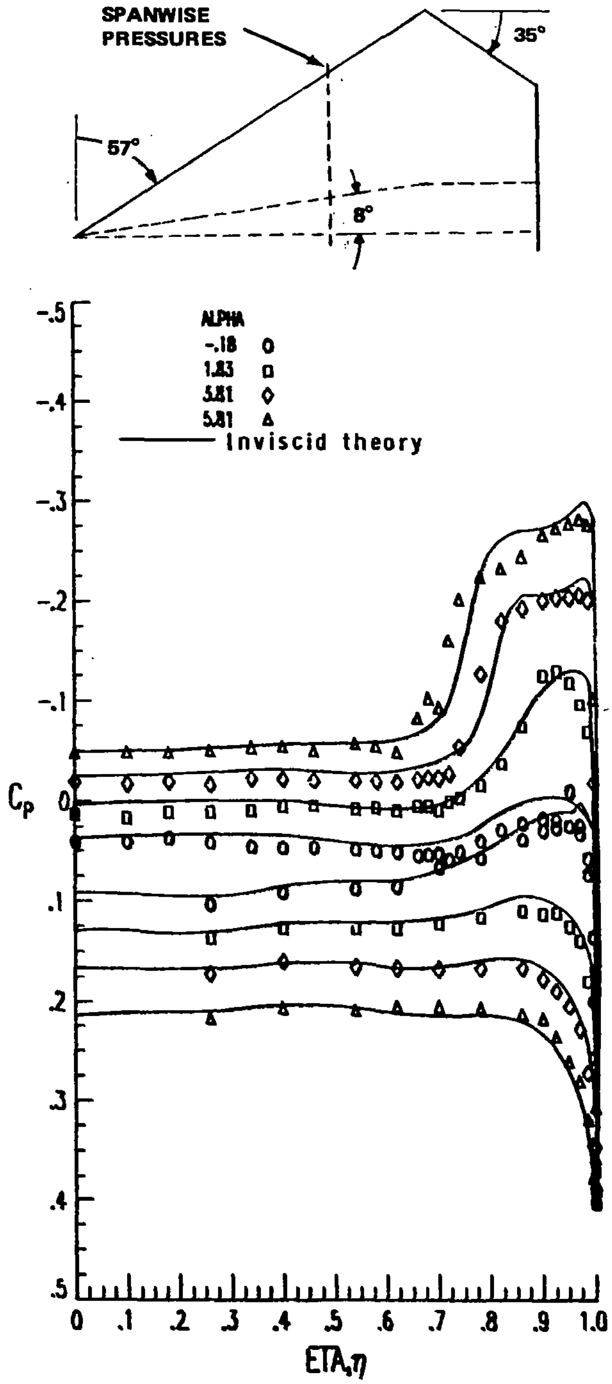


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Figure 1. - Comparison between experiment and COREL spanwise pressure distribution for a symmetric section at M = 1.70 (from ref. 13).

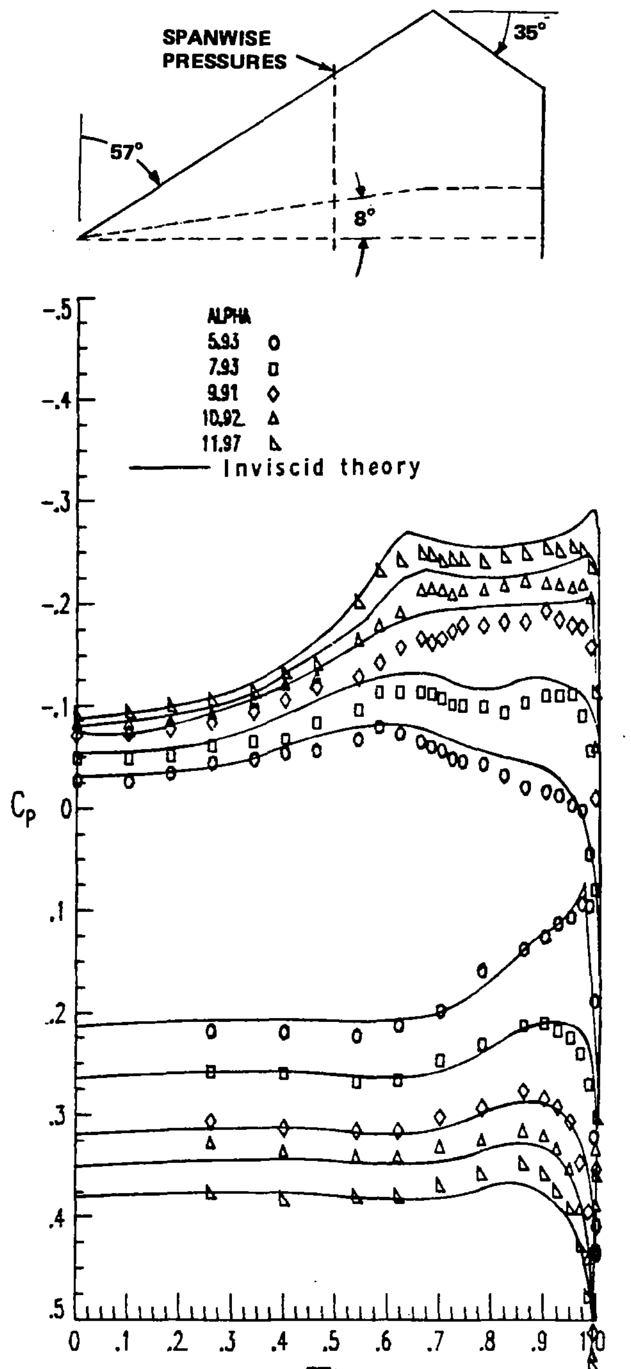


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Figure 2. - Comparison between experiment and COREL spanwise pressure distribution for a cambered section at M = 1.62 (from ref. 13).

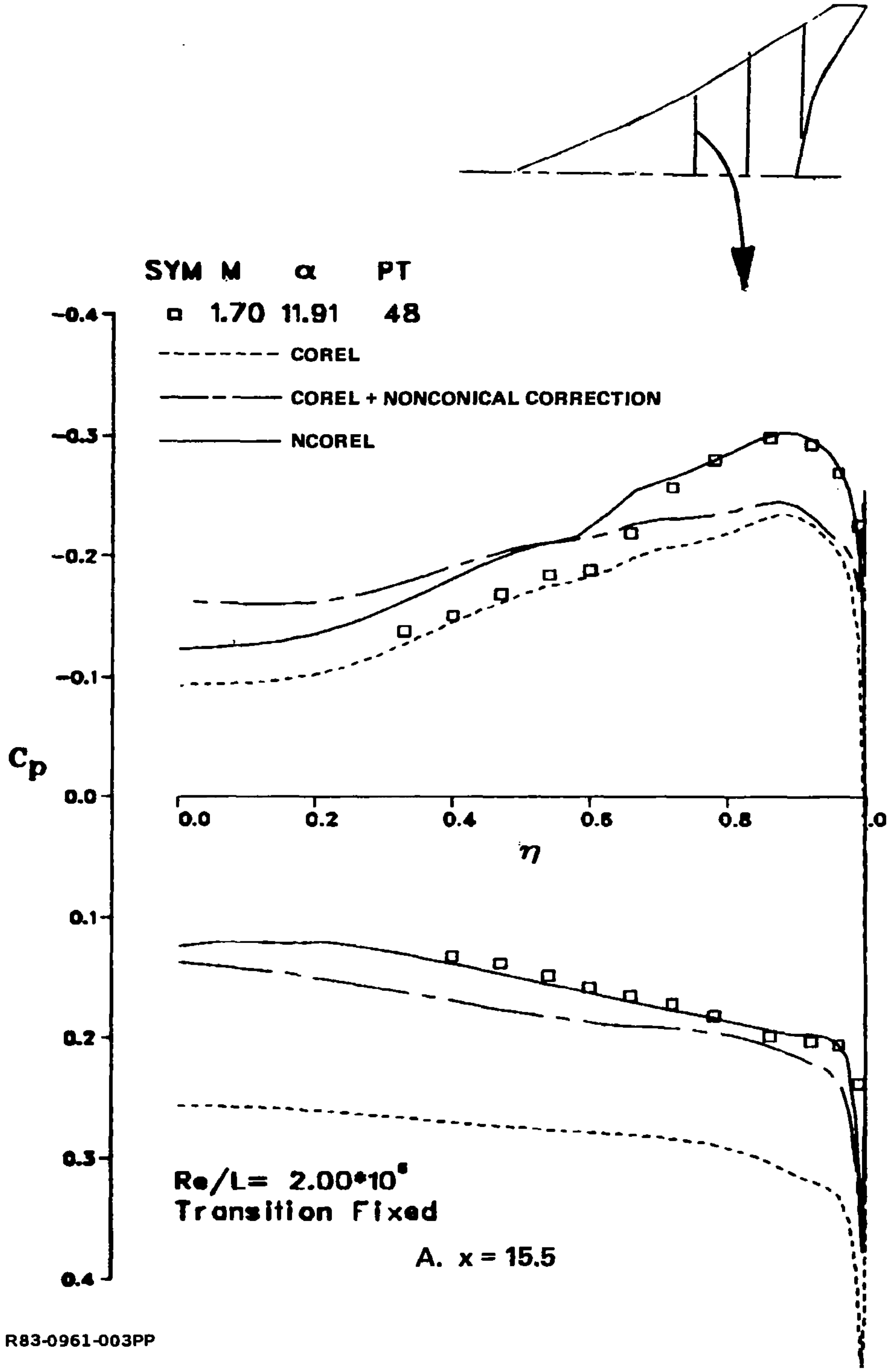


Figure 3. - Typical predictions of COREL and COREL + nonconical correction for the demonstration wing of ref. 15, and including NCOREL predictions, ref. 16.

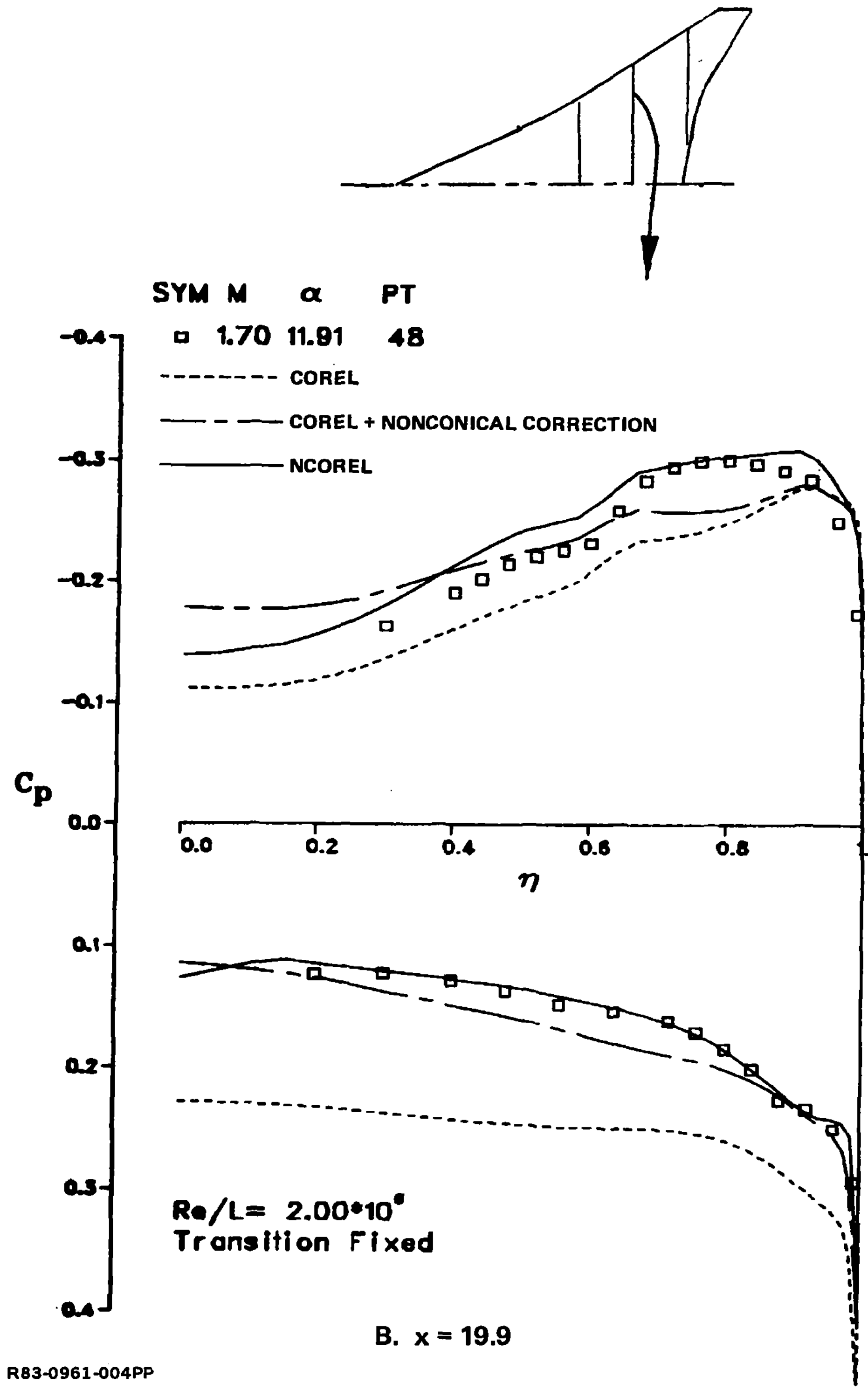


Figure 3. - Continued.

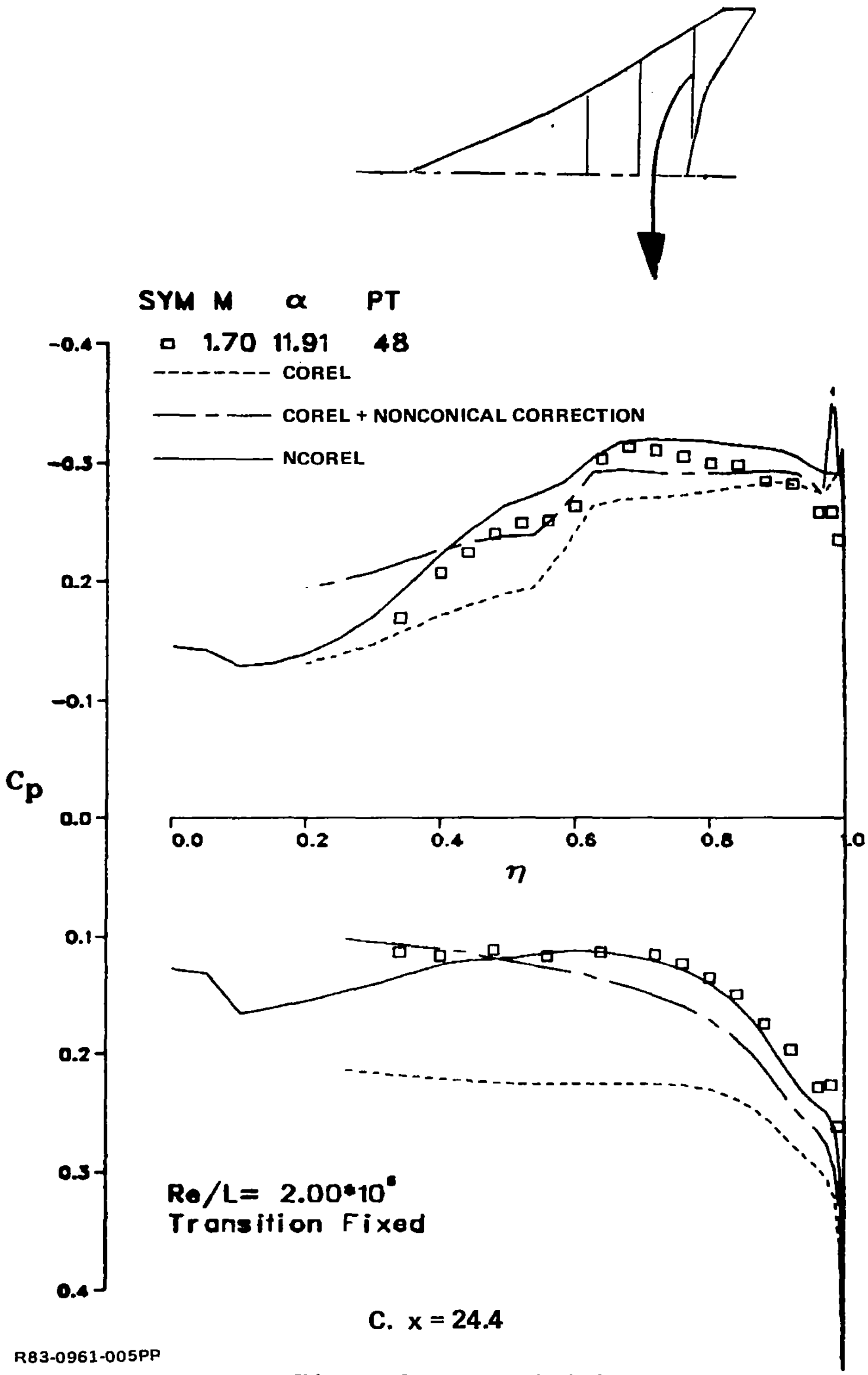


Figure 3. - Concluded.

Ref. 15. The nonconical correction to the COREL results provide predictions that are almost as good as the solution of the complete equations and demonstrates the value of the COREL code in performing wing design.

Several options in the W12SC3 code require illustrative examples. Representative problems are the basic analysis with and without the interference shell, the effect of the Carlson correction, and the mixed design-optimization. Figure 4 shows the panel model for the sample case given in the original Woodward II report, Ref. 5. A pressure distribution near the wing root is shown in figure 5. Figure 5A reproduces the results for the original example case ($M = 2.01$, $\alpha = 5^{o}$). This is the case for which data are available and the figure shows the problem with "wiggles" that can arise, the elimination of the wiggles with the

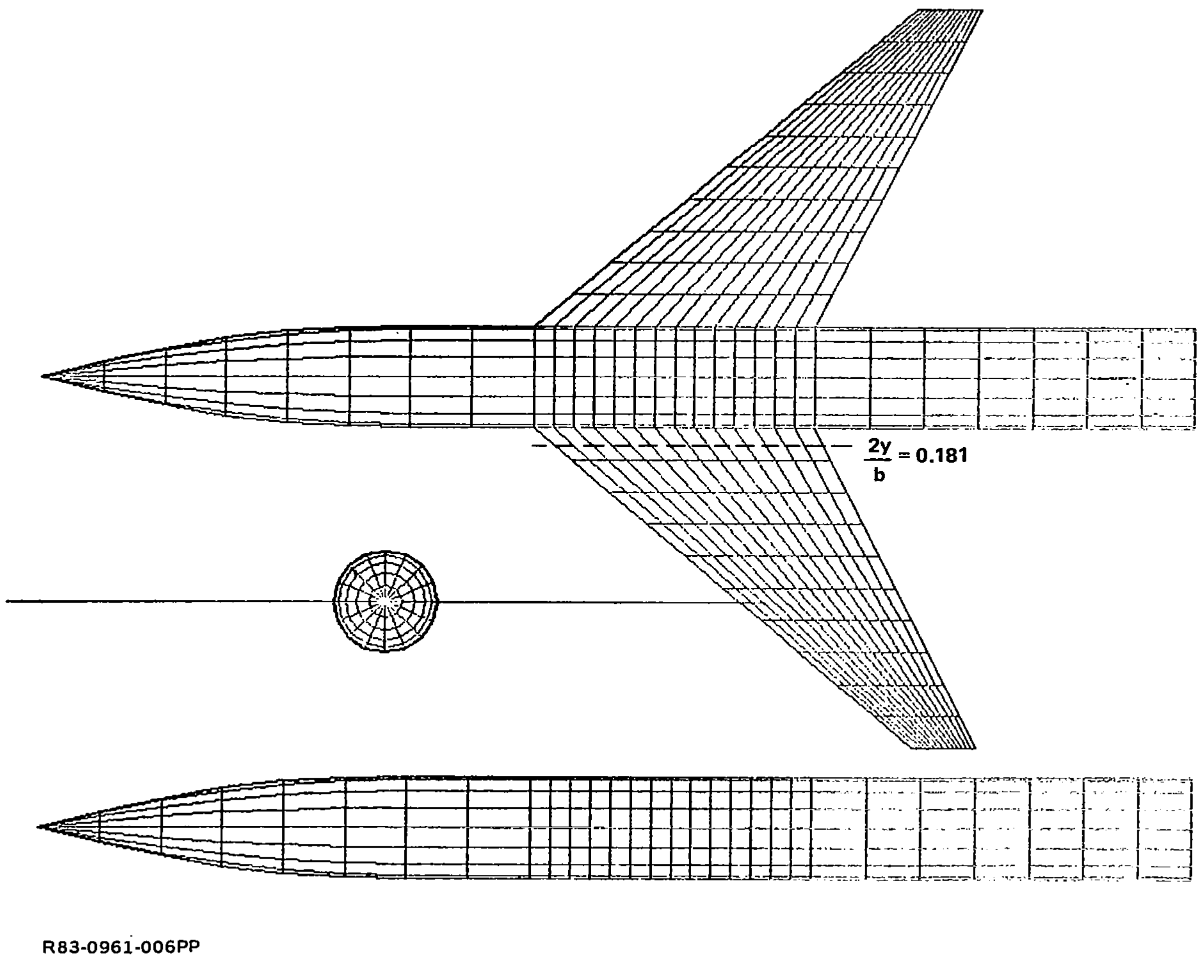


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Figure 4. - Singularity paneling for wing-body analysis.

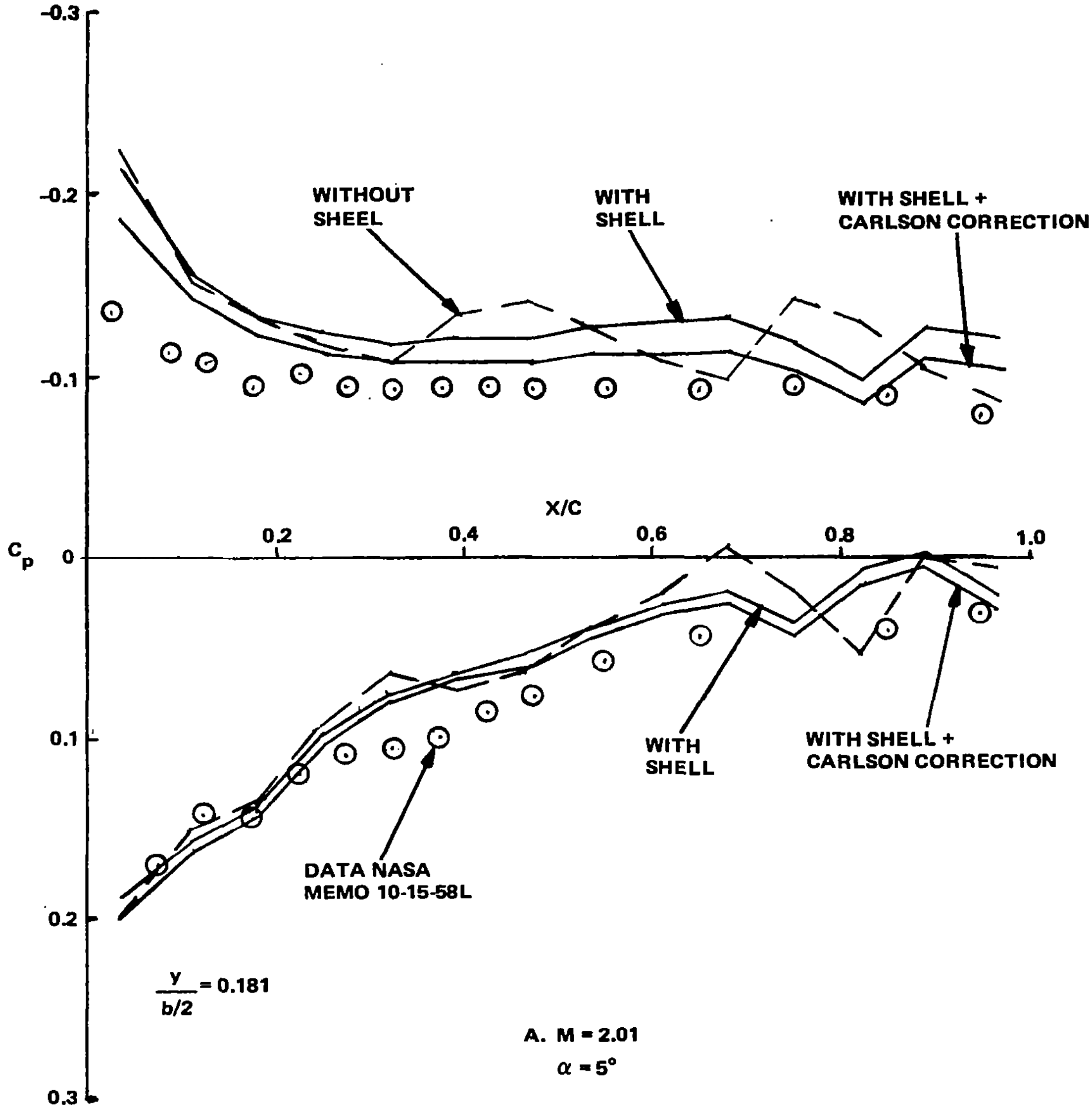


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Figure 5. - Wing-body analysis: effect of interference shell on W12SC3 wing pressures, and comparison with data.

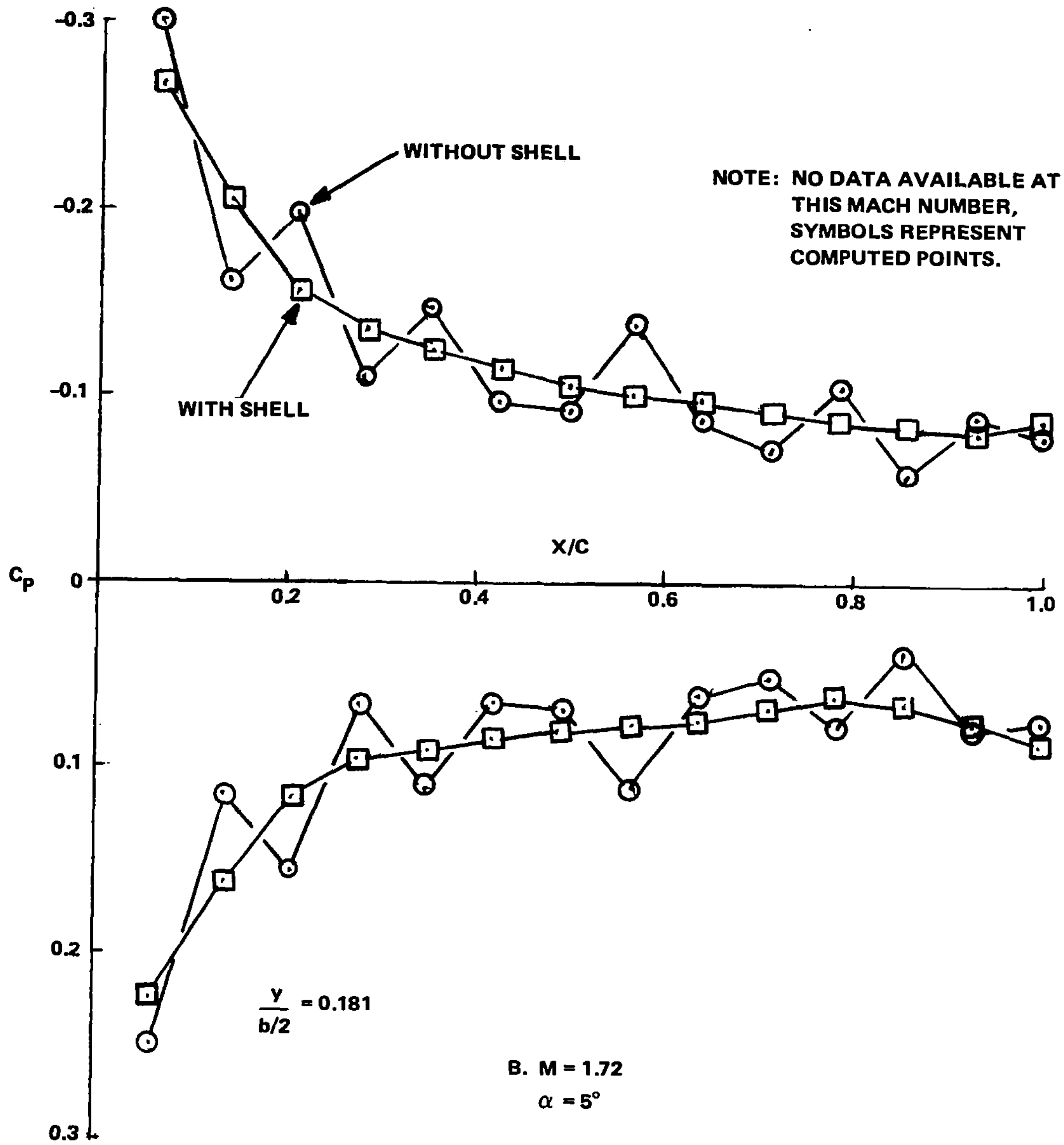


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Figure 5. - Concluded.

use of the interference shell, and the improved agreement with data that occurs when the Carlson correction is used. Figure 5B provides the same result for M = 1.72. This case shows the dramatic improvement in the wing-body interference results when the body source singularities are not required to account for the carry-over lift. Figure 6 shows typical results of the Carlson correction in a more severe case for which more exact analysis results are available, Ref. 16. Figure 7, taken from Ref. 17, provides the results for a typical case with a large body and canard.

An example of the use of the conical panel mixed-design-optimization for the planform given in figure 8 is presented in figure 9. In this case the mixed design option is used to study the sensitivity of the minimum drag to the level and extent of the prescribed pressure on the leading edge panel. This type of analysis is used to determine the target pressure distributions for the maneuver wing. Figure 10 shows the predicted optimum pressure distribution, while figure 11 provides a sample of the camber distribution. Notice that the optimization results in smooth pressure and camber distributions when the drag is minimized for the entire surface, even though the method does not explicitly require this. In some cases the results are not as smooth. Consider the cranked leading edge planform given in figure 12. In this case the minimum drag pressure and camber distributions, given in figures 13 and 14 respectively, show an irregular shape near the interface between the pressure-fixed and pressure-free boundary.

The experiment of Ref. 15 can be used to evaluate the drag predictions. The pressure predictions of W12SC3 corresponding to the case given in figure 3 are shown in figure 15. These results show generally good agreement except in the region near the leading edge where the crossflow is supercritical. In this case, the very good agreement with the drag data shown in figure 16 was obtained by taking the drag prediction of the W12SC3 code and replacing the predicted volumetric wave drag with the value obtained from the wave drag program of Ref. 18. These results are obtained despite the poor agreement with the pressure predictions near the leading edge. Other factors which are not accounted for in the analysis include the crossflow shock wave drag and the viscous interaction at the trailing edge. Also, note that the agreement with the lift and moment results is not as good as the drag polar (see figure 17).

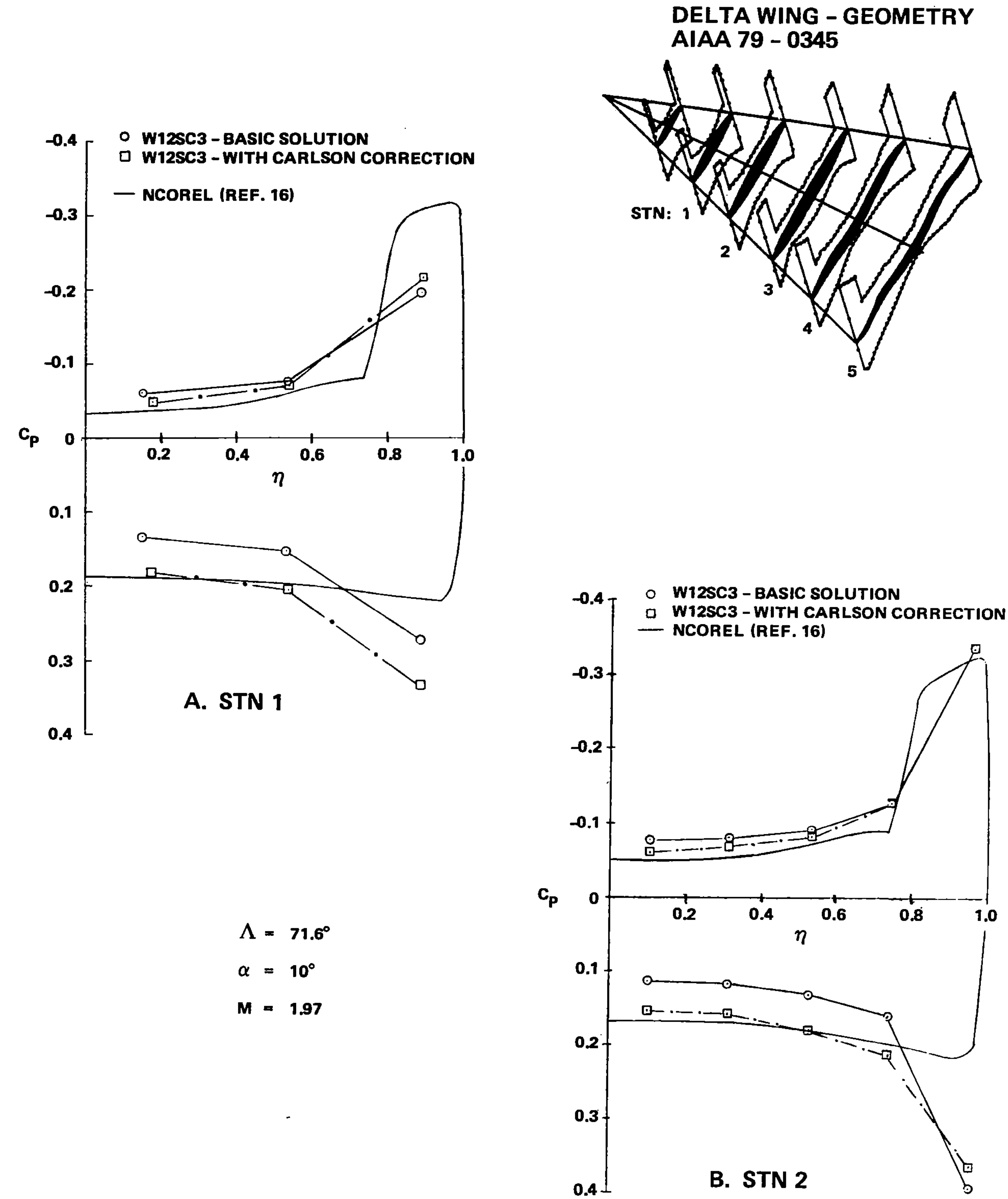


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Figure 6. - Comparison of W12SC3 with exact solution - effect of Carlson correction.

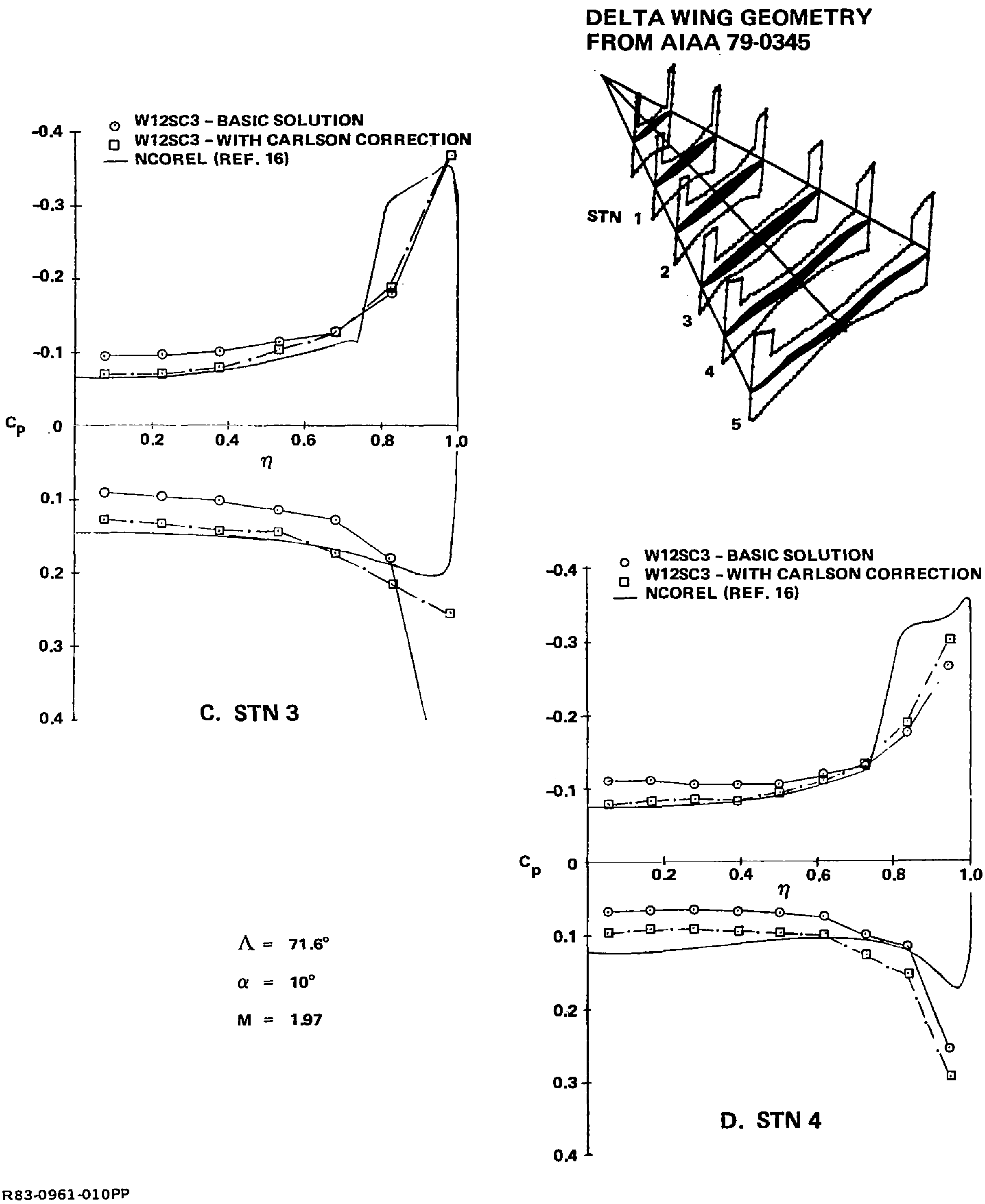
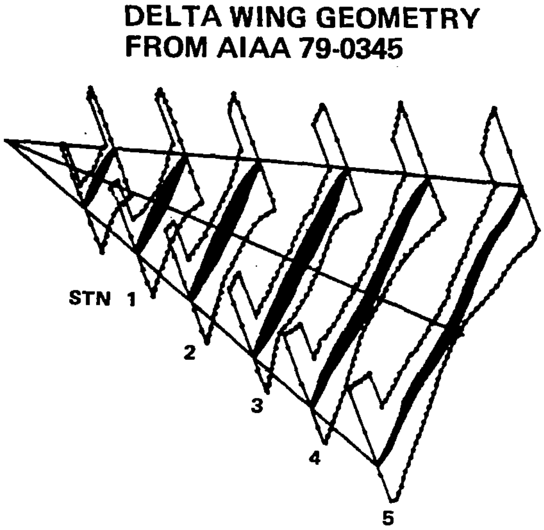



Figure 6. - Continued.



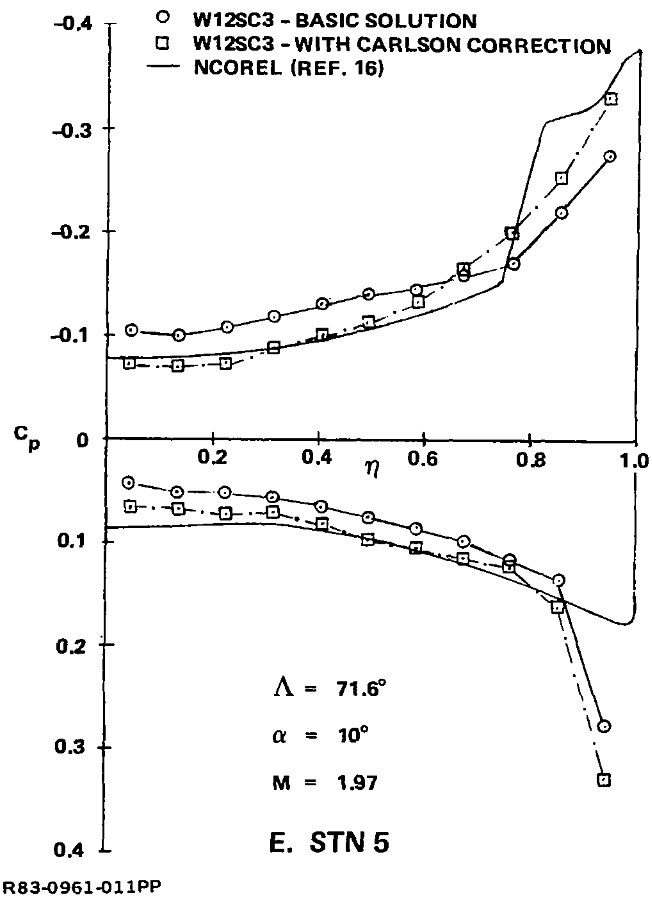
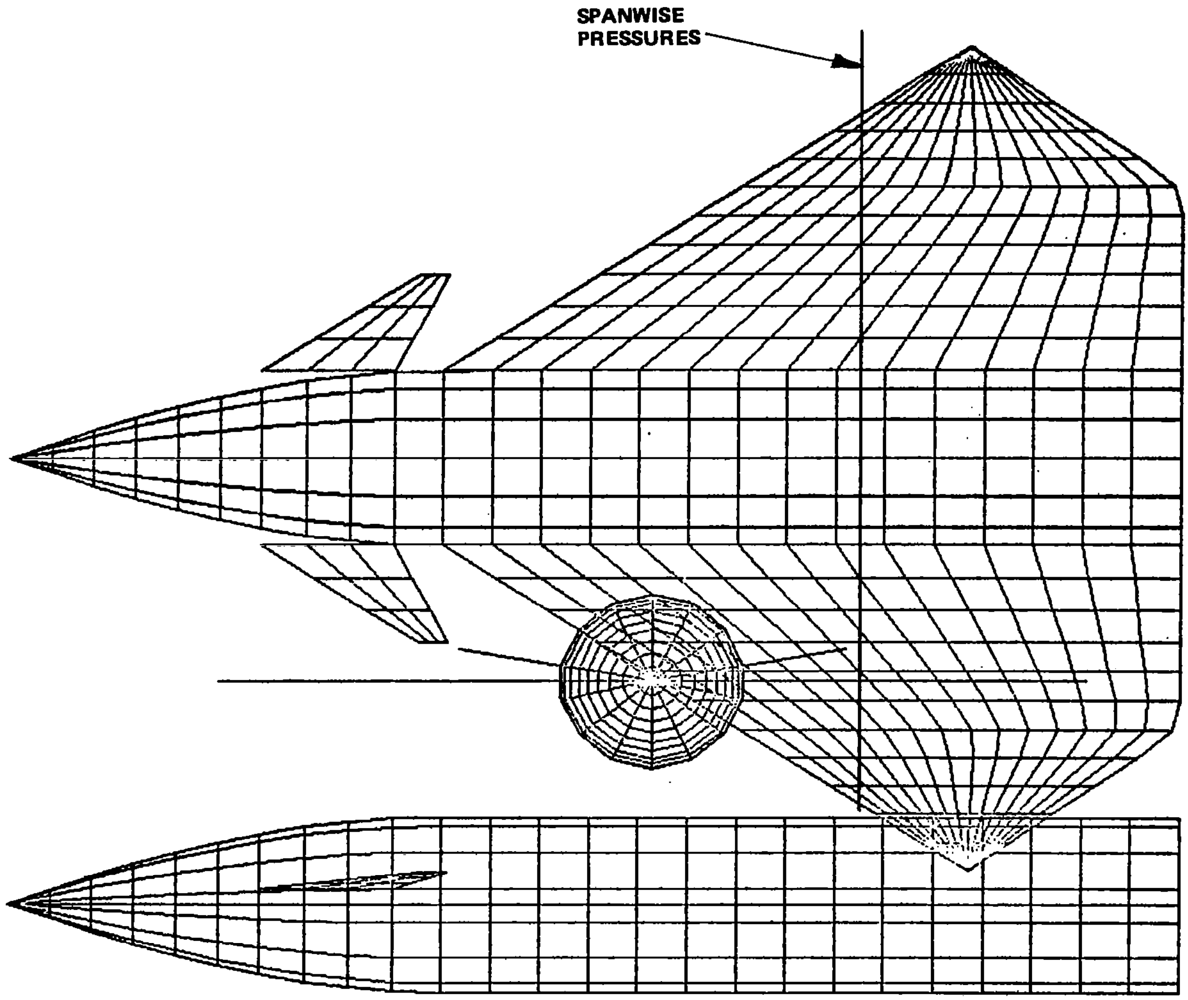




Figure 6. - Concluded.




A. PANEL MODEL FOR WING-BODY-
CANARD ANALYSIS

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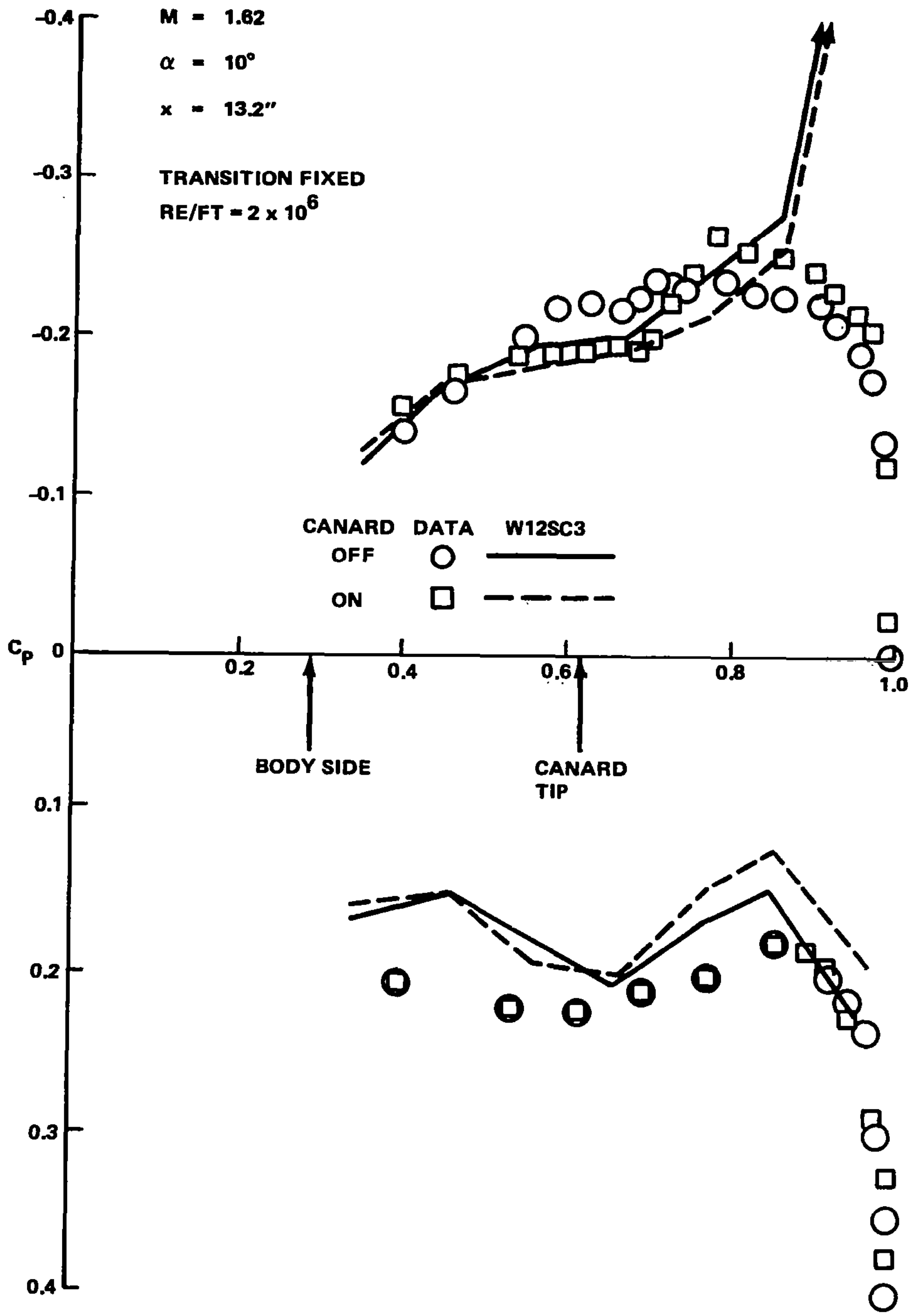
Figure 7. - Comparison of W12SC3 with conceptual wing-body-canard experimental data of ref. 15.




B. CAMBERED WING

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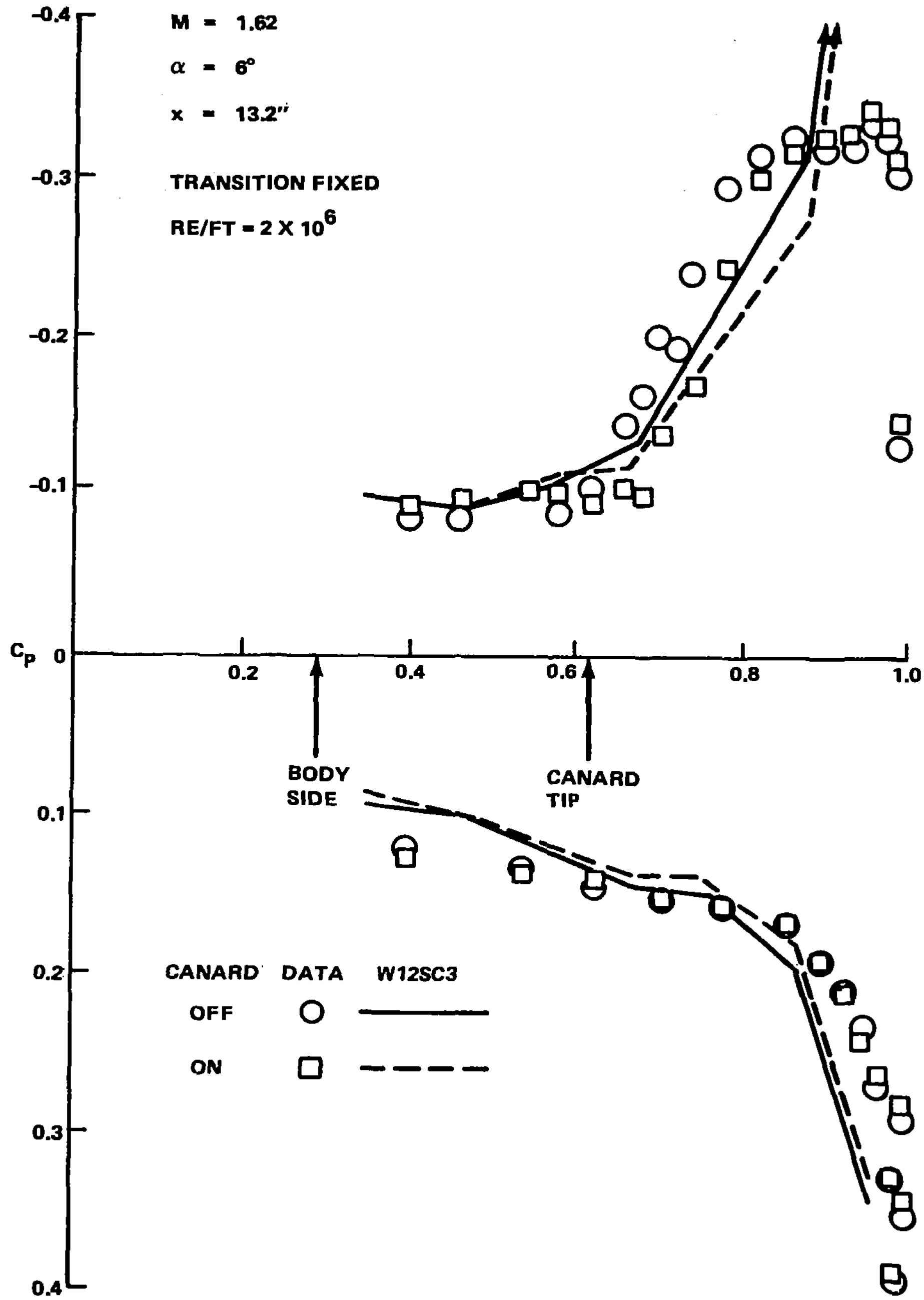
Figure 7. - Continued.




C. FLAT WING

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Figure 7. - Concluded.

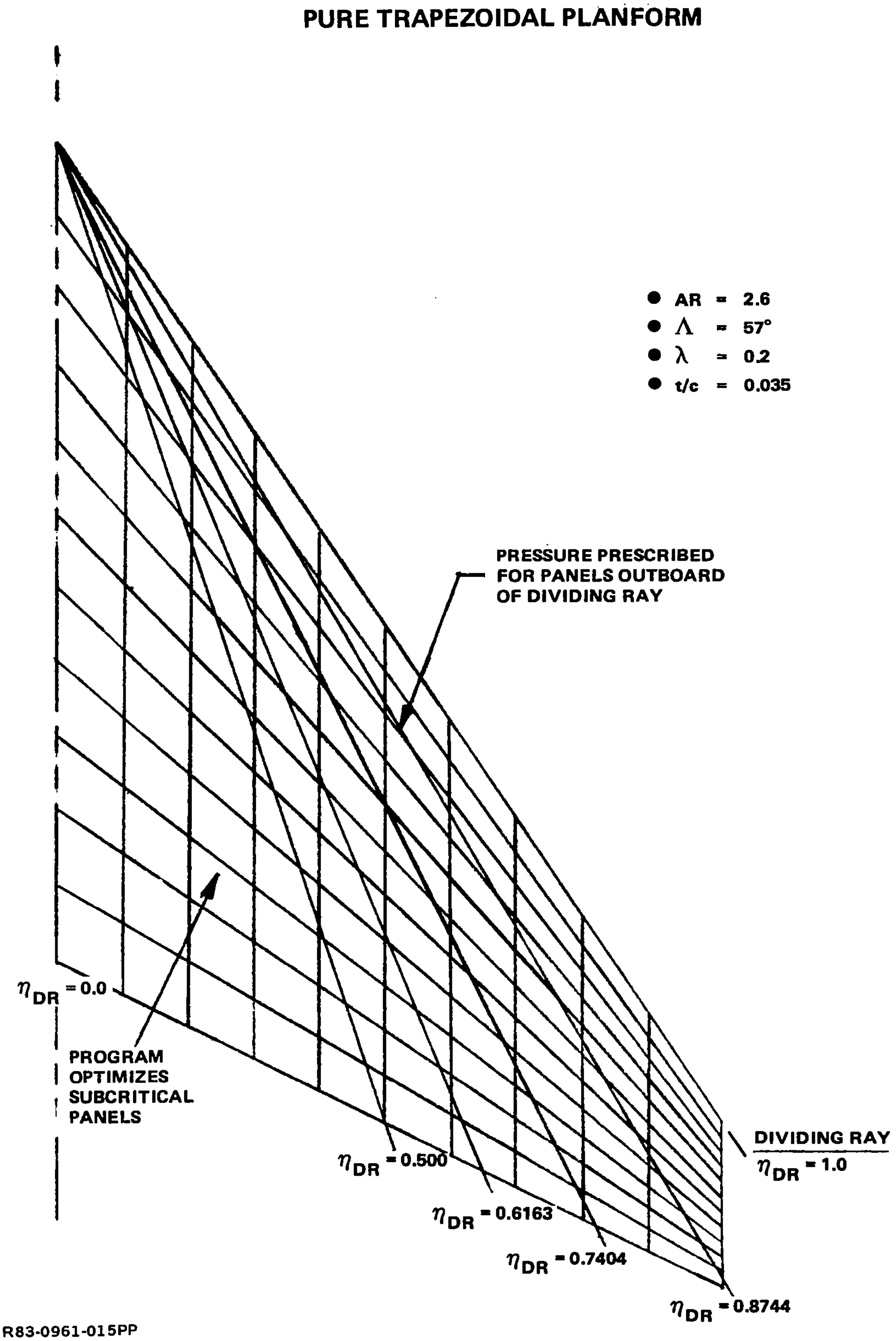


Figure 8. - Geometry and panel model for $SC^3$ wing design example.

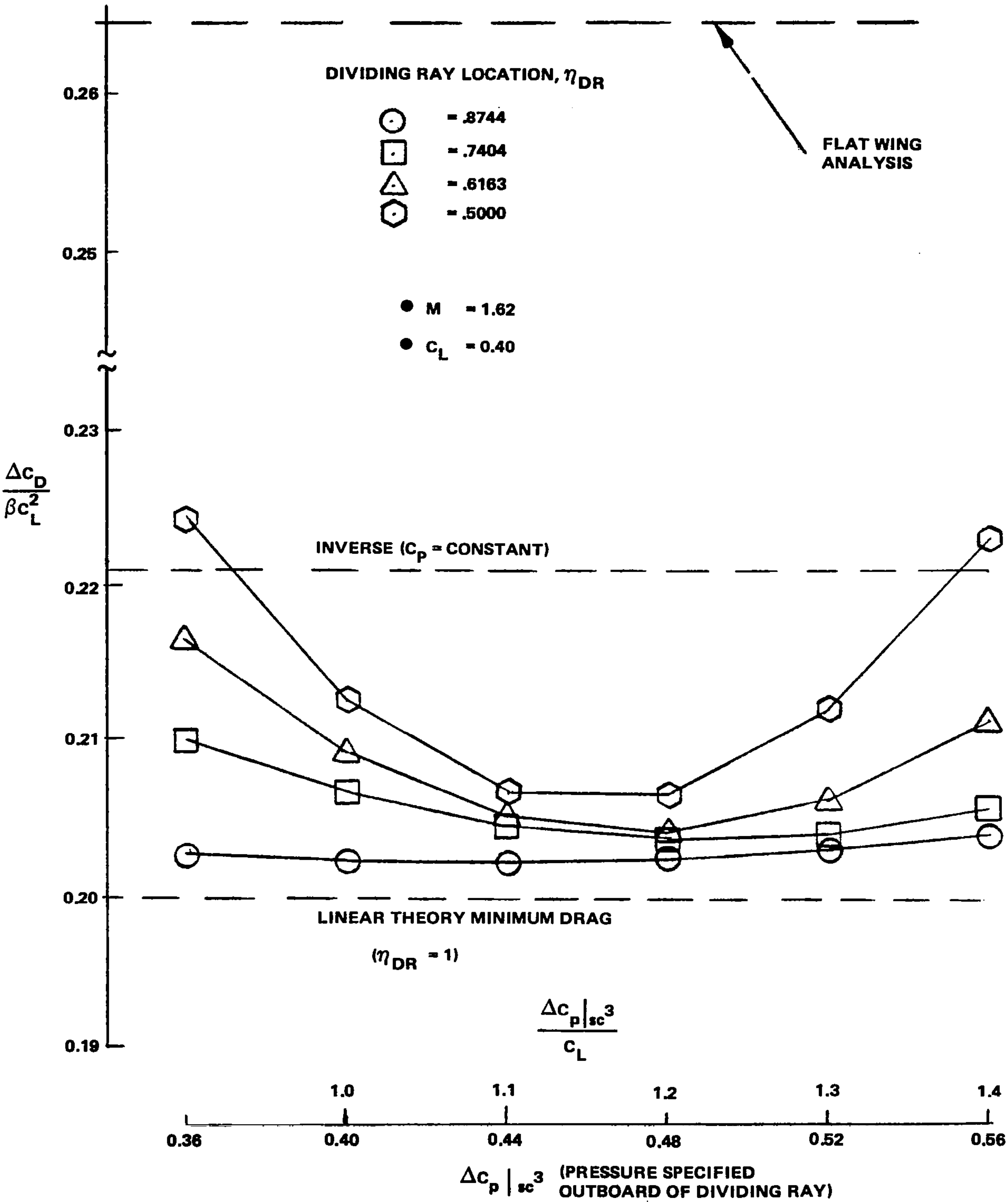


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Figure 9. - Drag performance of SC wing design from linear theory using trapezoidal planform of Figure 8.

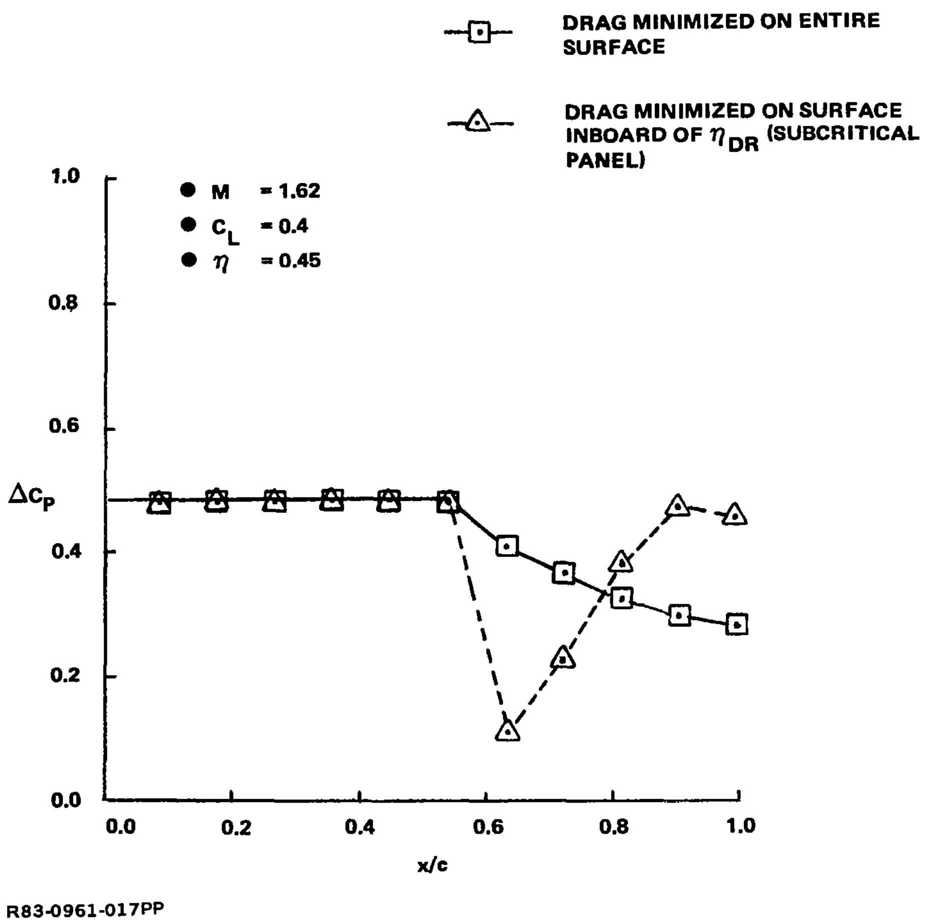


Figure 10. - Minimum drag pressure distributions for the $\eta_{DR}$ = 0.616 case shown in Figure 8.

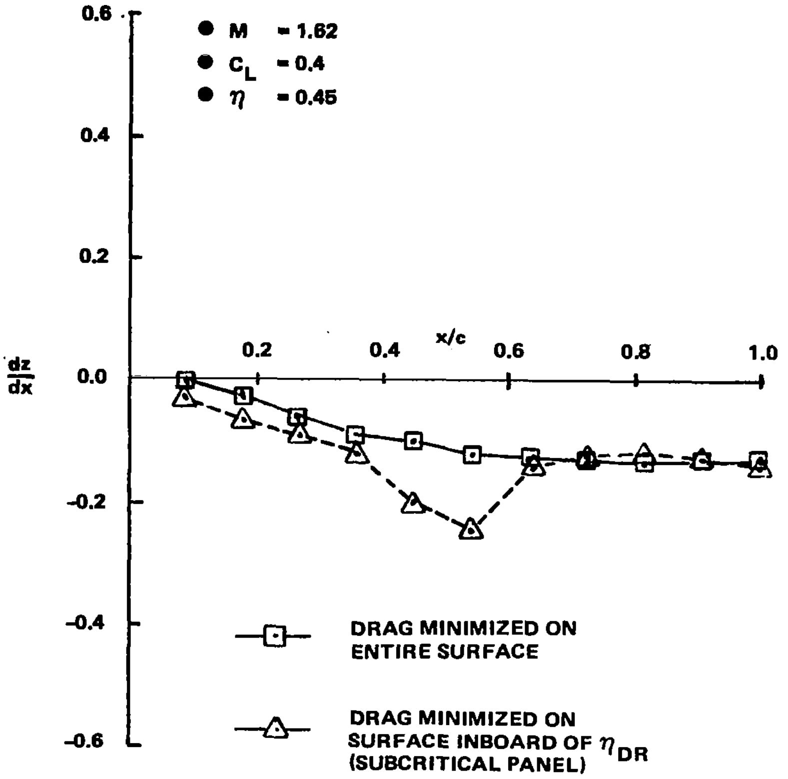


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Figure 11. - Minimum drag camber distributions for the $\eta_{DR}$ = 0.616 case shown in Figure 8.

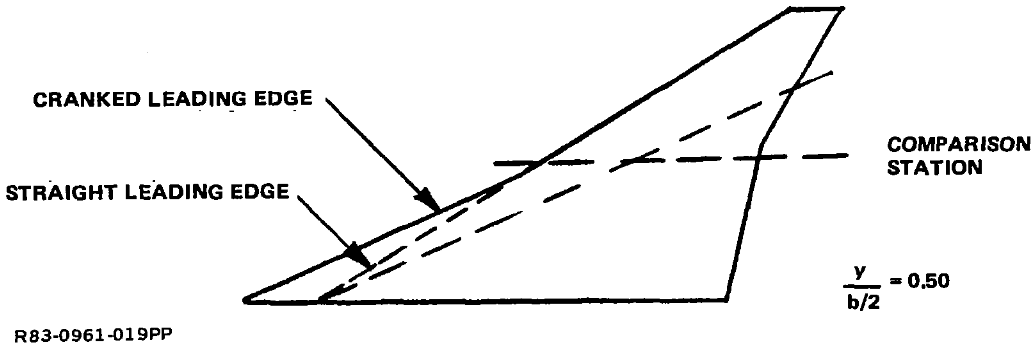



Figure 12. - $SC^3$ wing design model for cranked leading edge example.

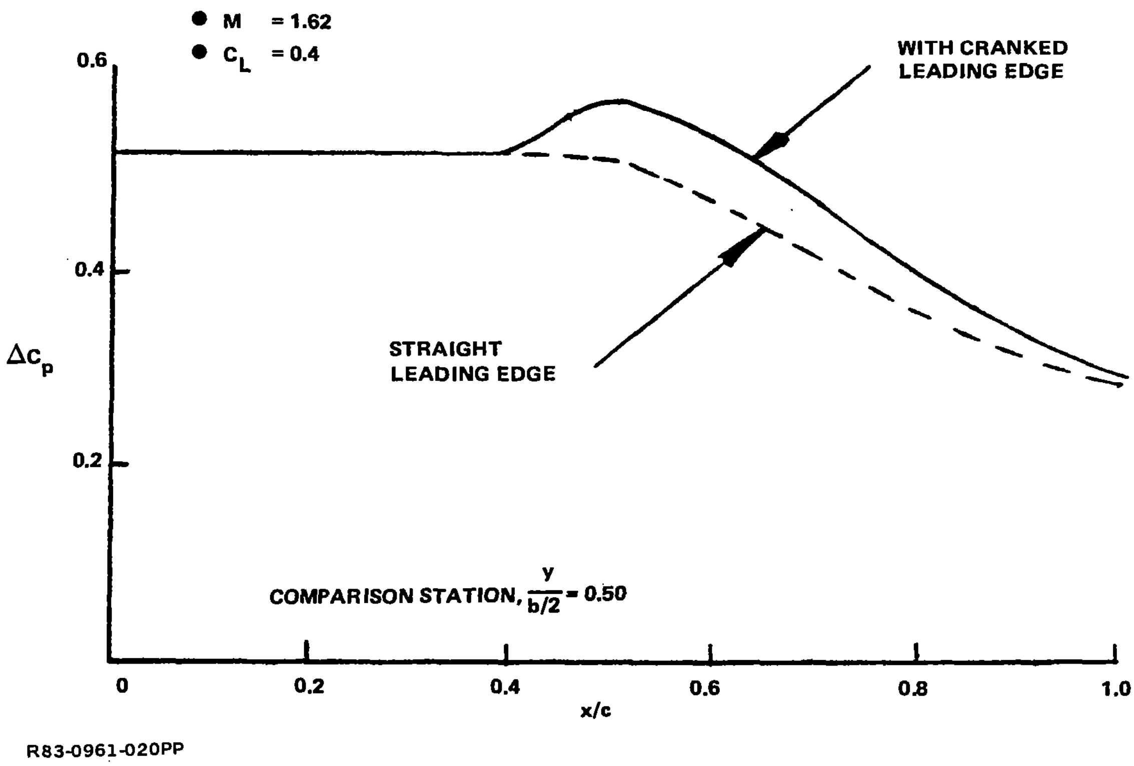



Figure 13. - Effect of addition of L.E. "crank".

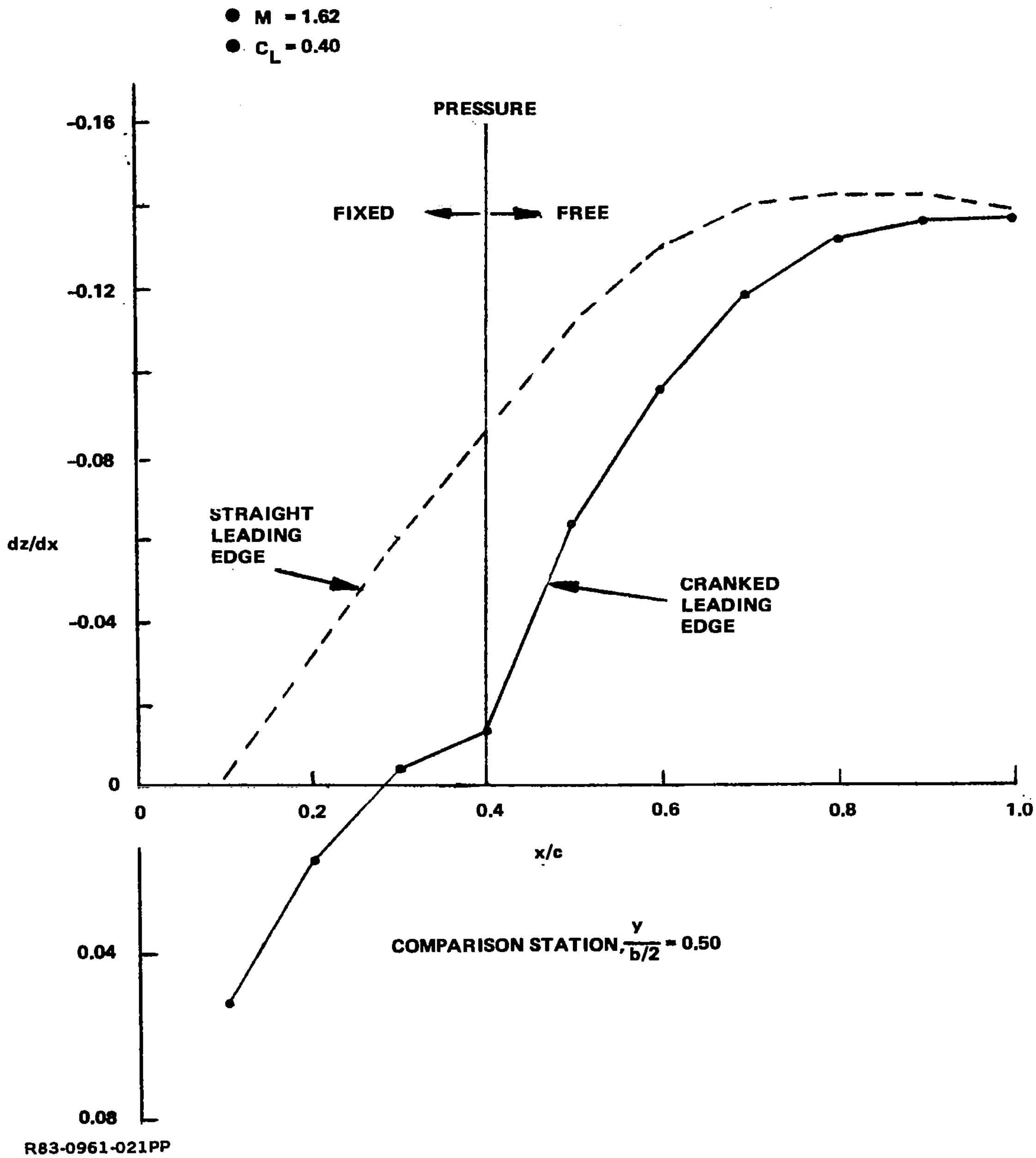
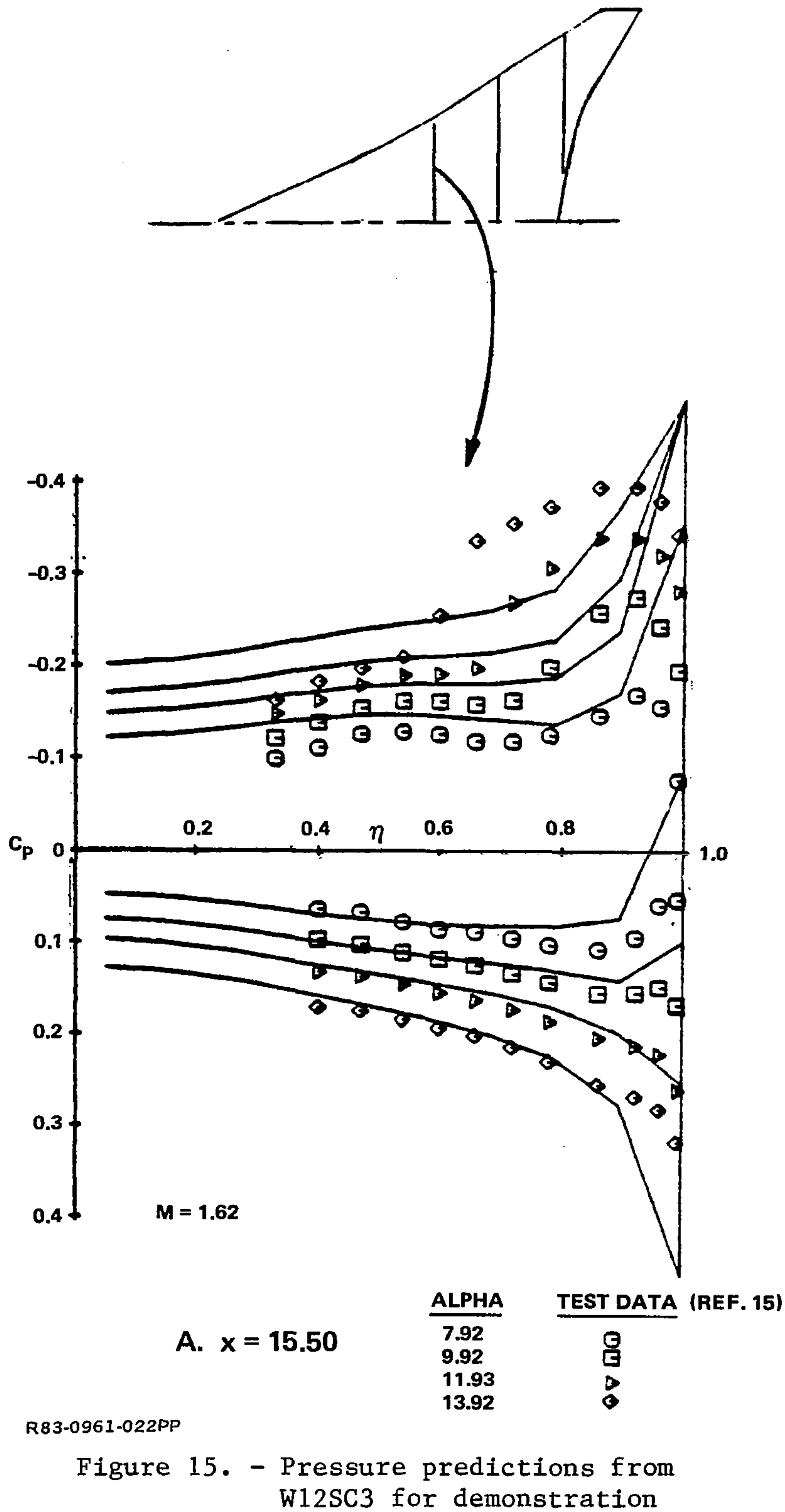



Figure 14. - Wing slopes for mixed design with straight and cranked leading edge.




A. x = 15.50

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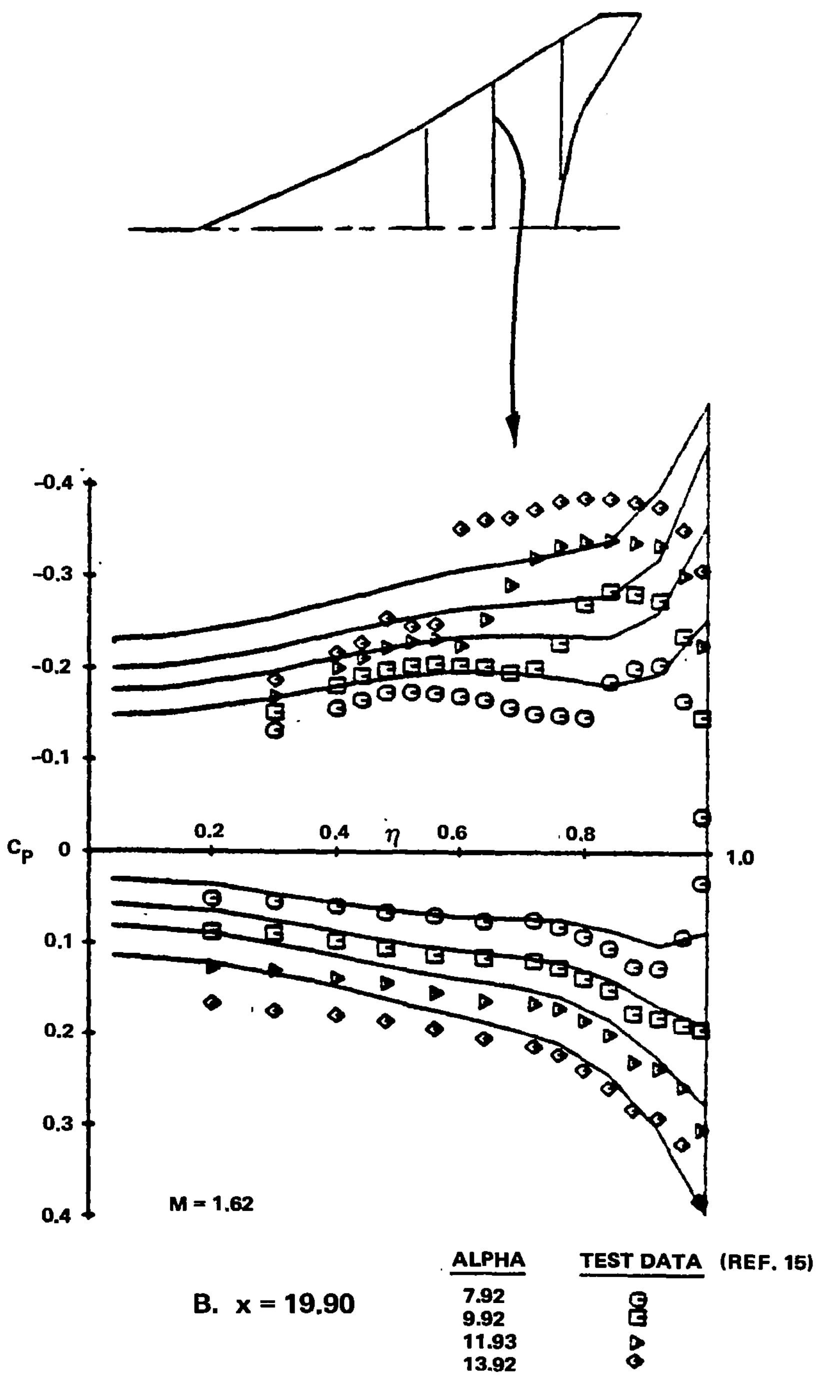
Figure 15. - Pressure predictions from W12SC3 for demonstration wing of ref. 15.




B. x = 19.90

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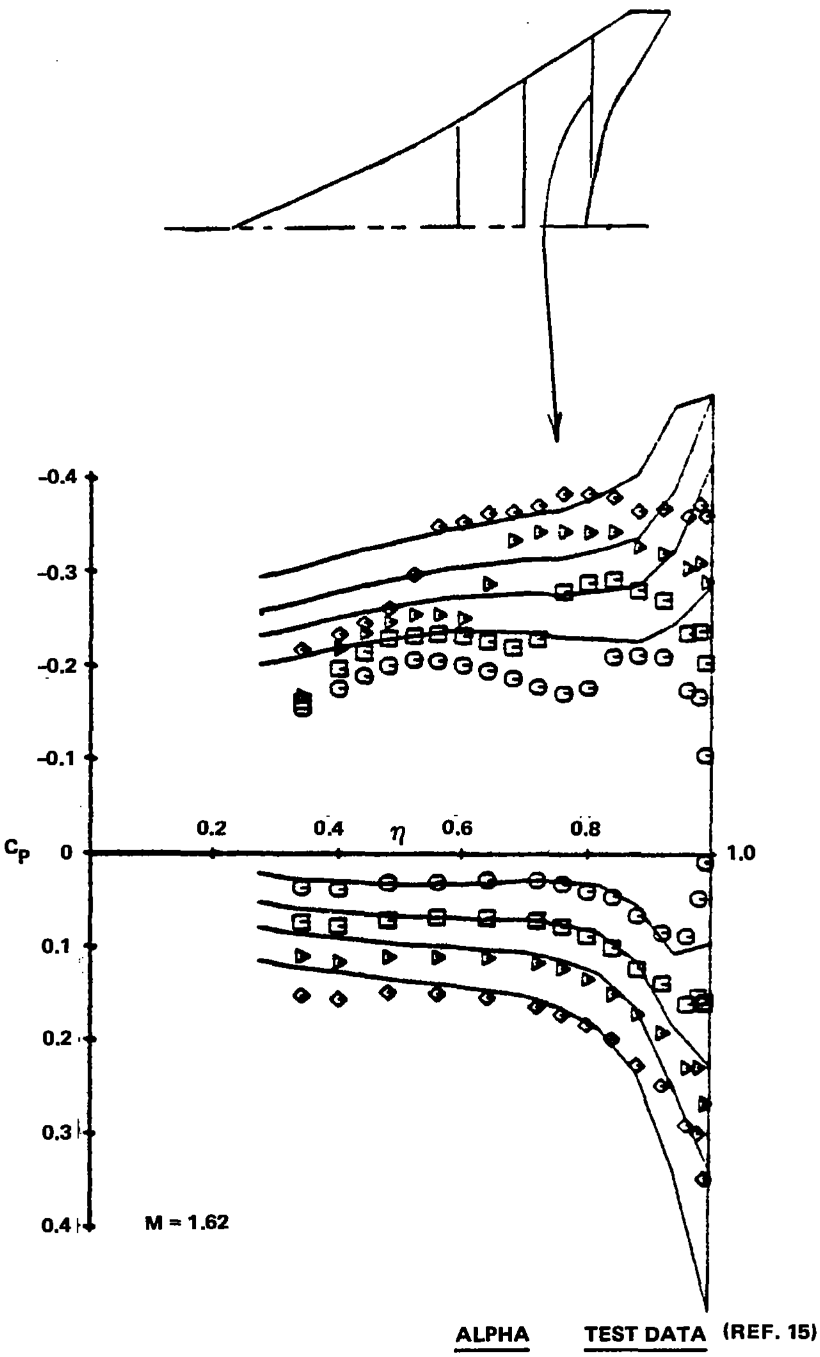
Figure 15. - Continued.




C. x = 24.40

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Figure 15. - Concluded.

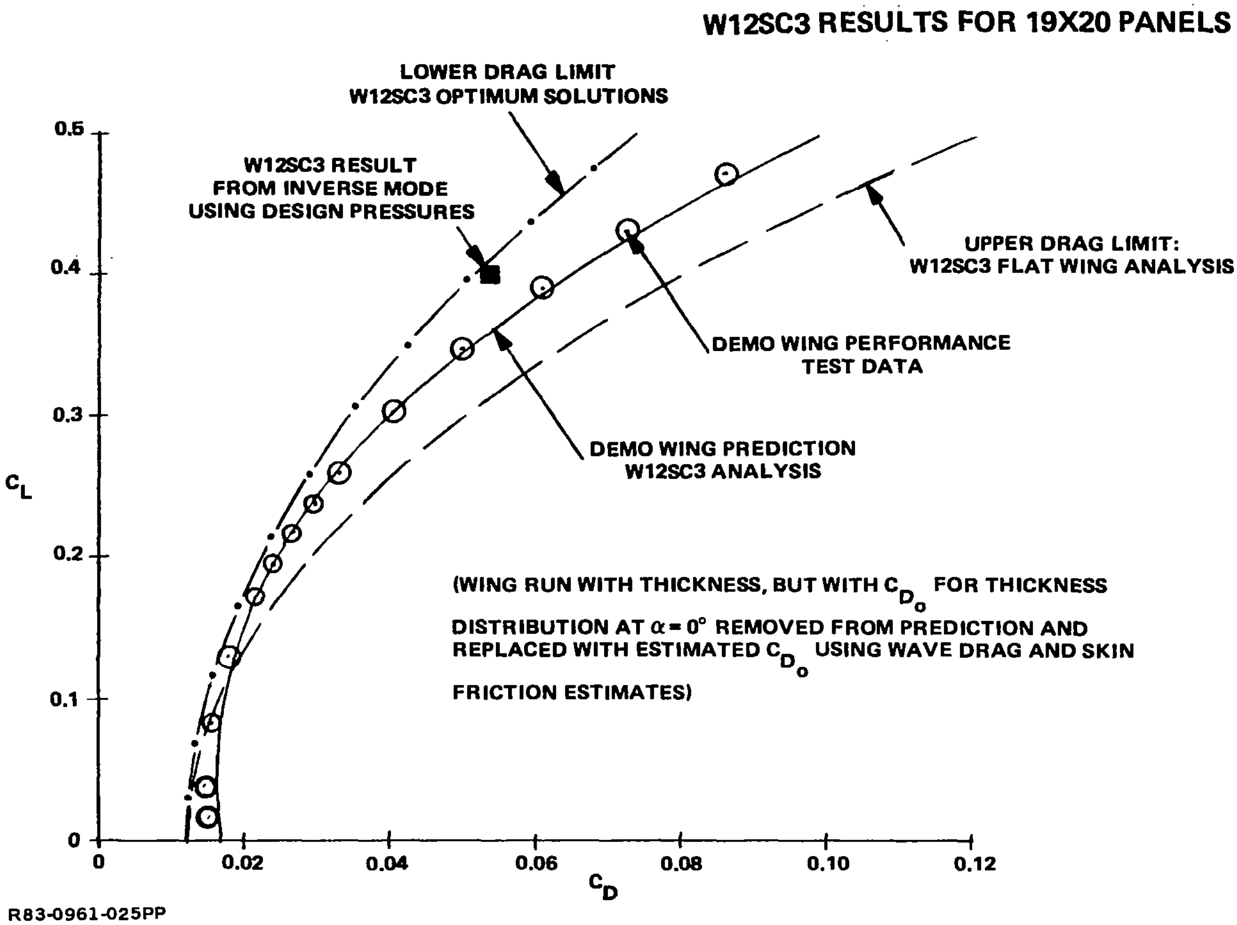


Figure 16. - $SC^3$ demo wing performance: basic leading edge, M = 1.62 (from ref. 15).

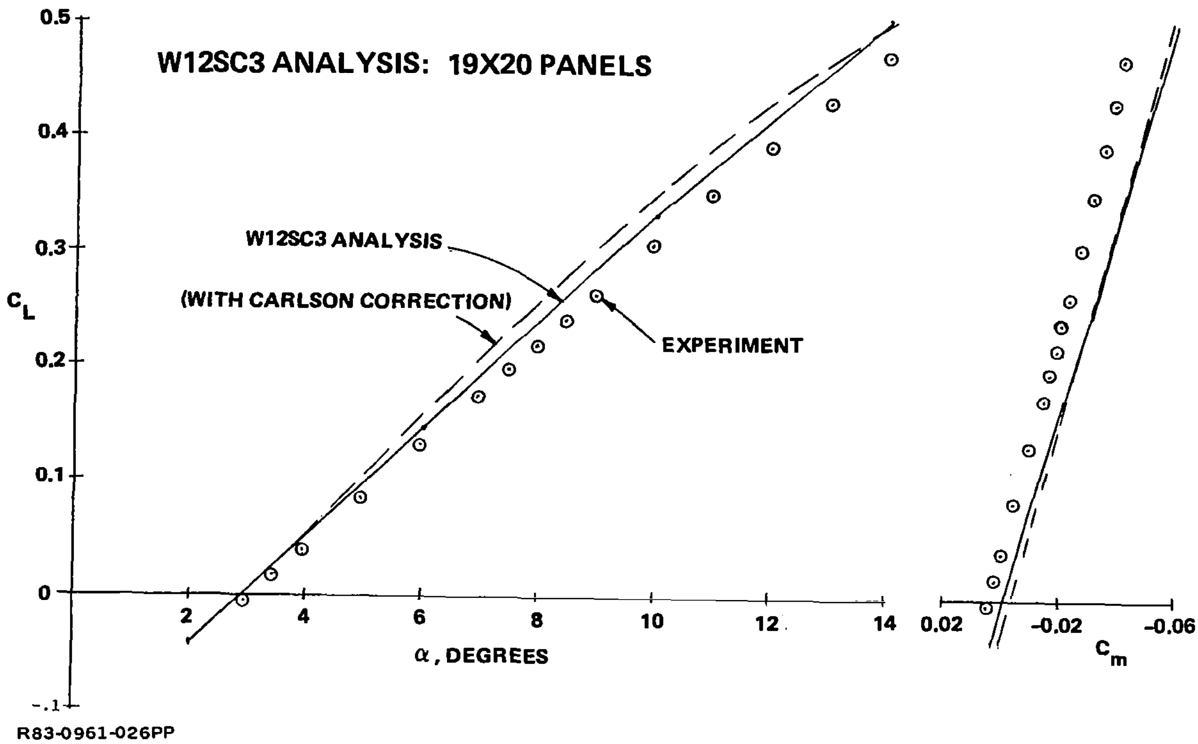


Figure 17. - $SC^3$ demo wing: lift and moment, basic leading edge, M = 1.62 (from ref. 15).

## SOME AREAS REQUIRING SPECIAL CARE

To obtain good results using computational aerodynamics methods, the user must understand the basic ideas and underlying assumptions used. In addition, he must develop his skills using the code by running some model problems and carefully studying the results. In this section we point out some of the things to look for in studying the results to ensure that the desired solution is in fact being computed, and include some comments on limitations that still exist in some areas.

In using COREL, certain checks should be made by looking at the output from each run:

1. Check the iteration history to verify that the SLOR iteration is converging.
2. Check that JSHMAX and JSHMIN, the maximum and minimum locations of the bow shock in the computational grid, are "reasonable". The value of JSHMAX should be at least two or three mesh points in from the mesh edge, and JSHMIN should be at least halfway between the body and the mesh edge. Normally, JSHMAX and JSHMIN are nearly equal after the solution is remapped.
3. Check that no points violate diagonal dominance by making sure that NPVD is zero in the iteration history.

If COREL does not work, it is normally due to a geometry problem or an "extreme" Mach number. (An "extreme" Mach number can be quantified relative to the sonic leading edge Mach number. If the Mach number normal to the leading edge is much greater than about 1.1, it is an "extreme" case, and is one for which the initial guess for the bow shock location is likely to be poor. The first step in troubleshooting a failed COREL run is to plot the input geometry points and verify that they are correct. The next step is to check the mapped body and shock locations. These should be relatively smooth, and the shock must always be outside the body. The singularity location should be checked to ensure that it is inside the leading edge. The initial shock position can be controlled by the input parameter EPSHKI. A small value (~0.5) will move the shock "out" in

the computational mesh (away from the body), while a large value (~1.6) will move the shock "in" in the grid.

The solution algorithm is extremely insensitive to changes in geometry typical of design-point work so that, once the code appears to be performing properly, the design work can be accomplished without excessive concern for the reliability of the computed results.

For W12SC3 calculations, the iteration history should also be checked to ensure that convergence occurs when the iterative solution procedure is used. For cases where W12SC3 does not converge, the direct solution algorithm can be used, although for large numbers of panels this option could become prohibitively expensive. In some cases, small changes in Mach number or panel layout elimmate convergence problems. No precise rules for doing this have been developed.

In defining geometry for COREL, two additional items require consideration. When using the Craidon geometry to define the section for analysis, adequate definition for the spanwise section must be provided near the leading dege. A rule of thumb is that several (3) points should be specified between the leading edge and one leading-edge radius aft of the leading edge. In addition, the point spacing should not change abruptly. This definition accuracy is consistent with the airfoil definition used in specifying modern transonic airfoils. However, because supersonic sections are usually thinner than transonic sections, their adequate definition requires points much closer to the nose when based on the chord. A second problem area is the analysis of spanwise sections for which the spanwise cut intersects the trailing edge. COREL requires that a spanwise section be defined beginning at the centerline. When the trailing edge is cut, the spanwise section must be continued to the centerline. A very thin section (0.1% semi-span) can be used to do this. Because the cases of interest have supersonic trailing edges, the addition of this artificial section does not affect the solution on the wing. However, the additional section should be smoothly appended to the actual section, and it must intersect the centerline such that the origin is included inside the section.

Similarly, the W12SC3 code also requires some special attention in several areas. The main area requiring special care is the modeling of wings that are just slightly non-coplanar. For these cases, the influence coefficients can become erratic with resulting "wiggles" in the pressure distribution. In order to avoid this problem, the geometry should be modeled as several straight segments spanwise, with dihedral breaks of at least 10° instead of with a continuously varying spanwise dihedral (camber) with a break of 1° or 2° between each segment. A second situation in which "wiggles" can arise is use of the arbitary body source solution alone to account for the wing-body interference; when this occurs, the use of an "interference shell" will practically eliminate the wiggles in the pressure distribution on the wing. This approach is slightly more expensive, but appears to cure the wiggle problem reliably.

One area in which the Craidon geometry contains a severe restriction on the generality of the input is the specification of canard twist. In order to include canard twist, the canard can be input as a nacelle in the W12SC3 input section. Finally, care should always be taken to ensure that a total of 20 spanwise rows of wing panels is not exceeded. This restriction in the USSAERO code can be overcome by using nacelle panels to replace canard or tail wing panels.

A problem that was discovered in implementing the "Carlson correction" is the accuracy of the spanwise velocity. Although the spanwise velocity off the surface is given accurately, the spanwise velocity on the surface is incorrect. An approximate correction based on uncambered wing results is made to the spanwise velocity used in the Carlson correction. Attempts to correct the spanwise velocity by fundamental changes in the equations were unsuccessful.

## COMPUTER PROGRAM DESCRIPTIONS

Both programs are designed to run on CDC computers with the NOS operating system. However, the codes are written to be essentially independent of the operating system and can, in fact, be converted for use on IBM computers without any particular difficulty. No general description of COREL exists, so that this report provides the overall description of the code. The actual COREL computer

code contains numerous comment cards describing the computations and allowing for code modifications. The W12SC3 code description is presented as changes from USSAERO, which has been described in detail in other reports.

One important distinction between the two codes is the coordinate system definition. In COREL, Z is aligned with the body axis and X is in the spanwise direction. W12SC3 uses the standard coordinate system in which X is in the body direction, while Y is the spanwise coordinate. These distinctions should be kept in mind while working with the codes.

## COREL Program

The following description provides sufficient information to troubleshoot problems and make code modifications. Figure 18 provides a chart with the overlay breakdown and the names of the subroutines. Figure 19 provides a map of subroutine calls by groups, together with a brief description of each routine.

1. Start the calculation by reading the NAMELIST, which defines the options to be employed in the current execution. This is done in the main program and with the use of BLOCK DATA for default values in the NAMELIST. The default values provide a sample case of an elliptic cone at angle-of-attack, which serves as a check case.

2. Establish the spanwise geometry to be analyzed in COREL. This is done in Program GEOM (Overlay, 1,0). Three choices are available: the program can generate simple model geometries internally, read in a specific spanwise section, or extract a spanwise section from the Craidon Geometry Data Set. The numerical calculation requires a table of $(r,\theta)$ values which describe the section in polar coordinates, the number of values, and the location of the singularity for the mapping. The $(r,\theta)$ values are generated internally from the given $(x,y)$ values. However, the origin of the $(r,\theta)$ coordinate system must be located inside the section; this is the reason that, at the centerline $(x = 0)$, the upper surface ordinate of the spanwise section must be positive and the lower surface ordinate must be negative. Some provision for translating the section to ensure that the

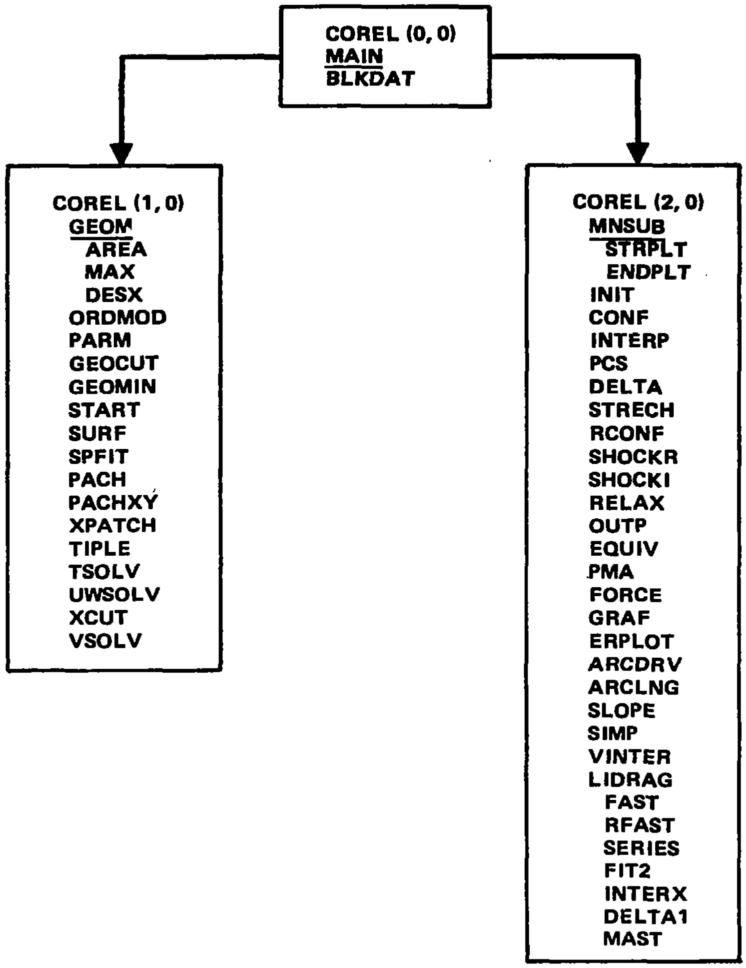


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Figure 18. - COREL program overlay structure.

origin is inside the spanwise section is included in the input instructions. The location of the singularity for the mapping is internally generated with the exception of a possible override when the spanwise section is input. In the case of sections extracted from the Craidon geometry, additional information is generated and saved for nonconical corrections. An option exists wherein the spanwise section to be used can be locally modified after it is established. Additionally, the spanwise section ordinates can be punched out and saved for other uses at this point if desired.

3. With the geometry established, the solution sequence begins. This is controlled by Program MNSUB (Overlay 2,0). The first step is to transform the

spanwise section via a Joukowski transformation and spline-fit the coordinates for interpolation to the computational grid location. (Note that this single transformation does not entirely eliminate the dependence of the body coordinate $\rho_B$ on its angular location, $\theta$.) An initial guess is made for the bow shock location and it is also mapped with the Joukowski transformation and spline fit. The computational mesh is then generated using the shearing transformation and the body and shock locations in the transformed plane. The body and shock data are interpolated to the grid locations, and the shock boundary is then located in the computational mesh so that the predicted location of the bow shock occurs several mesh points in from the edge of the grid boundary. This work is controlled via subroutine INIT. The computational grid is shown in figure 20 along with the nomenclature used in the code for the grid indices.

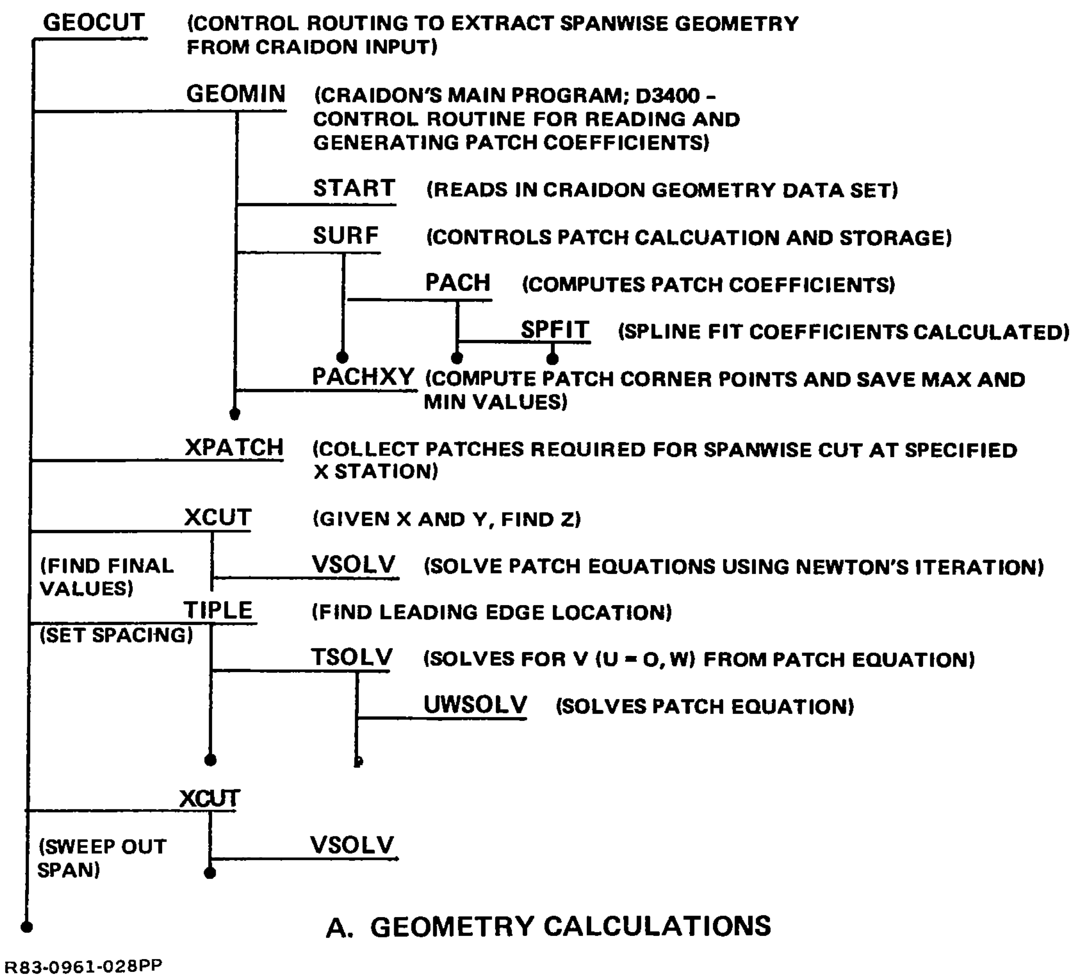


Figure 19. - COREL subroutine map.

- MNSUB (MAIN PROGRAM FOR NUMERICAL SOLUTION)
  - STRPLT (ROUTINE TO INITATE PLOTTING)
  - INIT (INITIAL MAPPING, SPLINE FIT, AND MESH ESTABLISHMENT)
    - CONF (CONFORMAL MAPPING OF BODY)
    - PCS (SPLINE FIT COEFFICIENTS FOR BODY)
    - SHOCKI (ESTIMATE OF BOW SHOCK)
    - CONF (CONFORMAL MAPPING OF SHOCK)
    - PCS (SPLINE FIT COEFFICIENTS FOR SHOCK)
    - DELTA/INTERP (INTERPLATE BODY DATA TO GRID POINTS)
    - DELTA/INTERP (INTERPOLATE SHOCK DATA TO GRID POINTS)
  - STRECH (COMPUTES THE MAPPING METRIC AND THE FREESTREAM VELOCITIES AT THE GRID POINTS)
    - RCONF (INVERSE OF MAPPING TO SET MESH POINTS IN PHYSICAL PLANE)
    - ARCDRV (FIND SECTION DATA)
      - ARCLNG (COMPUTE ARC LENGTH OF SECTION)
      - SLOPE (FIND SLOPES OF SECTION)

B. NUMERICAL SOLUTION CALCULATION - PAGE 1

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Figure 19. - Continued.

- MNSUB (CONTINUED)
  - RELAX (SLOR ITERATION FOR SOLUTION OF POTENTIAL EQUATION)
    - SHOCKRL (REMAP USING COMPUTED SHOCK LOCATION)
      - STRECH (SEE ABOVE)
    - ERPLOT (PRINT PLOT OF ITERATION HISTORY)
  - OUTP (GIVEN SOLUTION, COMPUTE RESULTS OF INTEREST)
    - FORCE (COMPUTE LIFT AND DRAG)
    - VINTER (INTERPOLATE UPPER AND LOWER SURFACE PRESSURES TO SAME LOCATION)
    - SIMP (INTEGRATE SPANLOAD TO GET LIFT)
    - EQUIV (MAKE NON-CONICAL CORRECTION TO THE PRESURES DISTRIBUTION)
      - ARCLNG (COMPUTE SECTION ARC LENGTH)
      - VINTER (INTERPOLATE INPUT GEOMETRY DATA TO MESH POINTS)
      - PMA (PRANDTL - MEYER ANGLE AND INVERSE)
    - LIDRAG (COMPUTE SPAN "e" FOR GIVEN SPANLOAD - INDUCED DRAG DUE TO TRAILING VORTICES)
    - GRAF (PLOT RESULTS)
  - ENDPLT (ROUTINE TO STOP PLOTTING)

C. NUMERICAL SOLUTION CALCULATION - PAGE 2

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Figure 19. - Concluded.

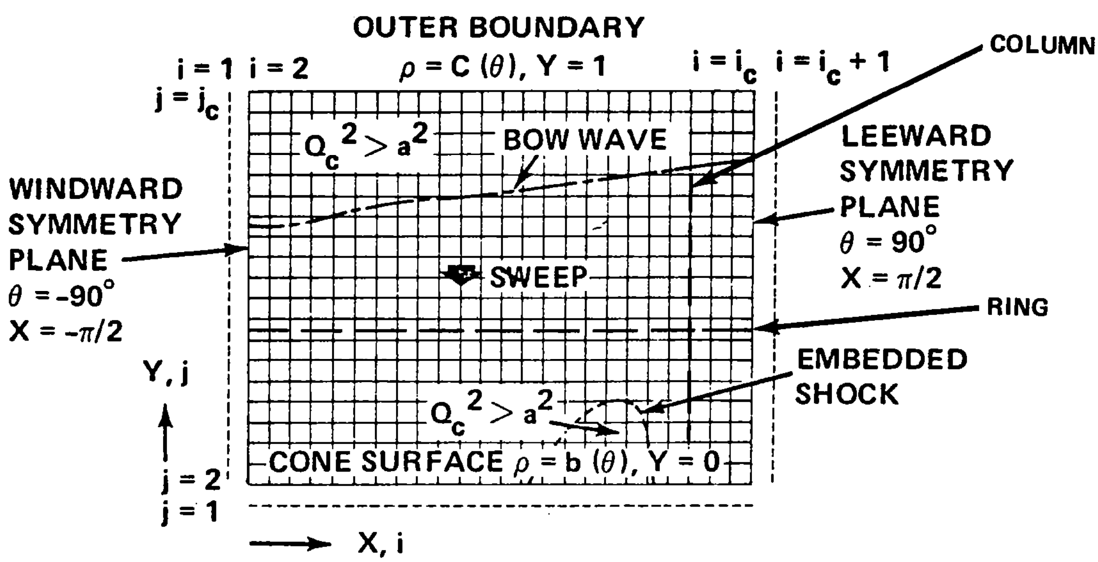


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Figure 20. - Computational plane for COREL calculations, and program index nomenclature.

4. With the grid established, subroutine STRECH is used to compute the values of the mapping metric and freestream velocity values at the grid points. The initial values of the boundary conditions are also set. Additional information required for output processing is also generated.

5. The finite-difference equations are solved using the Successive Line Over Relaxation (SLOR) algorithm in subroutine RELAX. The program uses a split sweep, so that a part of the grid is swept around the body (column) and part of the sweep starts from outside the bow shock and moves in toward the body (ring). The main sweep is considered the ring relaxation. Column relaxation is used to avoid possible numerical instabilities. For the first 50 iterations (nominally), no special provision is made concerning the bow shock. After this initial set of iterations, the location of the bow shock is determined after each iteration, saved, and the potential (F) set to zero outside the bow shock. This is done to ensure that the bow shock is clearly defined. Thereafter the iteration sweep starts just outside the maximum location of the shock in the grid, rather than the outer edge, to save computer time. After 100 iterations in the first grid (nominally), the iteration is halted and the actual computed shock shape used to remap the computational domain. This is done so that the bow shock is located along a constant grid line in the computational mesh to improve both computational efficiency and accuracy. Once the maximum number of iterations is reached or the maximum change of the potential between any two iterations is less than the prescribed convergence tolerance, the iteration stops. A print plot of the convergence history is then provided. The iteration history is traced by printing out the maximum change of the potential and its location, the average change of the potential, the maximum residual, the number of supersonic points, the number of points violating diagonal dominance, and the values and locations of the maximum and minimum positions of the bow shock. This provides sufficient information to evaluate whether or not the solution has converged. Virtually all of the computation time for the entire job is expended in the SLOR iteration.

6. Once the potential F is found and the SLOR iteration is terminated, the flowfield results are computed in subroutine OUTP. The calculation is made to compute the pressure coefficient, cross flow Mach number, total Mach number, and

velocity components. Generally, these results are printed out only on the surface but, as an option, they can be output at each grid point in the field. This information is repeated with more details on the surface, where the velocities are output in a variety of coordinate systems. The next set of computed results provide information for computing the surface streamline location. The bow shock and sonic line locations are then computed and stored for use in the graphics routines. Lift and drag are computed next, both in the computational and physical planes. $\Delta C_p$ is computed and optionally output for use in the W12SC3 code. The spanload is computed, printed out, and Fast Fourier Transform analyzed to determine the span "e". Optionally, the modification of the pressures to account for nonconical effects is then carried out and printed. The final step is to call the graphics routine to plot the results.

The SLOR solution is carried out on a sequence of grids, usually two, in order to reduce computing time. The grid spacing is divided by two at each successive grid refinement. The standard grid sequence is nominally 30 x 30 and 60 x 60. In the standard version of the code, 60 x 60 is the maximum grid size.

7. The final COREL step in a combined COREL/W12SC3 run is to save the spanwise pressure distribution $\Delta C_p$ vs $\eta$ (with or without the non-conical correction, at the user's option) for use in the conical mixed-design-analysis and mixed-design-optimization options of W12SC3.

I/O Units and Large Core Arrays Used by COREL

COREL uses the following units for I/O and Storage:

| UNIT | USE |
|---|---|
| 5 | Input |
| 6 | Output |
| 7 | X, $C_p$ output for plots |
| 8 | Spanwise section punched output |
| 10 | Craidon geometry data |
| 14 | Craidon patch cut data |

| | |
|---|---|
| 20 | Equivalent conical section data |
| 32 | Data set for W12SC3 |
| 99 | Graphics |

There are six large arrays which primarily control the amount of core required by COREL:

| Common Block | Array | Contents |
|---|---|---|
| BLK2 | F | The potential function |
| | H | The non-singular portion of the metric of the mapping |
| BLK3 | UI<br>VI<br>WI | The freestream velocity components at the grid points |
| FF | FFS | An analytically determined value of the singular part of the metric of the mapping. |

These arrays are normally defined to be 60 x 60.

The Craidon surface patch program (Ref. 6) uses bicubic splines to provide a smooth definition of the surface. The coefficients of the spline equations used in the program are stored in core. Because the patch information is generated and used in an overlay separate from the flowfield solution, these large arrays do not control the maximum program size. The arrays required for the geometry information are:

| Common Block | Array | Contents |
|---|---|---|
| PATBLK | PATXY (4,600,2) | Wing panel corner points; 4 corners, 600 panels, 2 surfaces |
| XPAT | PATCHX(14,400) | Bicubic surface patch matrix; 4 x 4 x 3 for 150 patches on 2 surfaces ($S_i = MB_iM^T$, i=X,Y,Z; see Ref. 7) |

| Common Block | Array | Contents |
|---|---|---|
| XPAT | PATCOR(4,150,2) | Panel corner points on local spanwise row of panels; 4 corners, 600 panels, 2 surfaces. |

These arrays can be redimensioned if more patches are required. The arrays eliminate most of the file searches and drastically reduce execution time.

## W12SC3 Program: Changes From USSAERO

Major modifications have been made to the USSAERO "B" code to produce the W12SC3 code. Some modifications were made to correct, revise, and improve the code's basic geometric and aerodynamic capabilities. Others were made to allow solutions to be found by direct matrix inversion techniques. Still more were made to implement the various design and optimization options, including a constant-strength vortex panel capability. For the $SC^3$ effort in particular, modifications were needed to implement the conical design and optimization options, as well as the Carlson Correction. Finally, modifications were made to provide an interference shell capability for improved wing-body calculations.

The net result of all of these code modifications is that the W12SC3 program is substantially different from the USSAERO "B" program. For brevity, only major differences between the two will be discussed. As a guide, W12SC3 program overlay structure and flow charts are presented as figures 21, 22, and 23.

### Direct Matrix Inversion Techniques

As an alternative to the available iterative solution methods, code additions were made to allow use of direct matrix inversion techniques. Subroutines TRPOSE, TRIXY, SOSCAP, RNRW, FUTSOL, QUAS, and INV were added and provide elementary matrix operations (transpose, multiplication, and inversion). Overlay OLAY50 was added and is used to form "higher order" matrices from the matrices of aerodynamic influence coefficients. These matrices are common to all the analysis, design, and optimization solutions (e.g., $A_{WW}-A_{WB}A_{BB}{}^{-1}A_{BW}$). For full

analysis cases, the specific solution for a given set of boundary conditions is calculated in subroutine DIRECT.

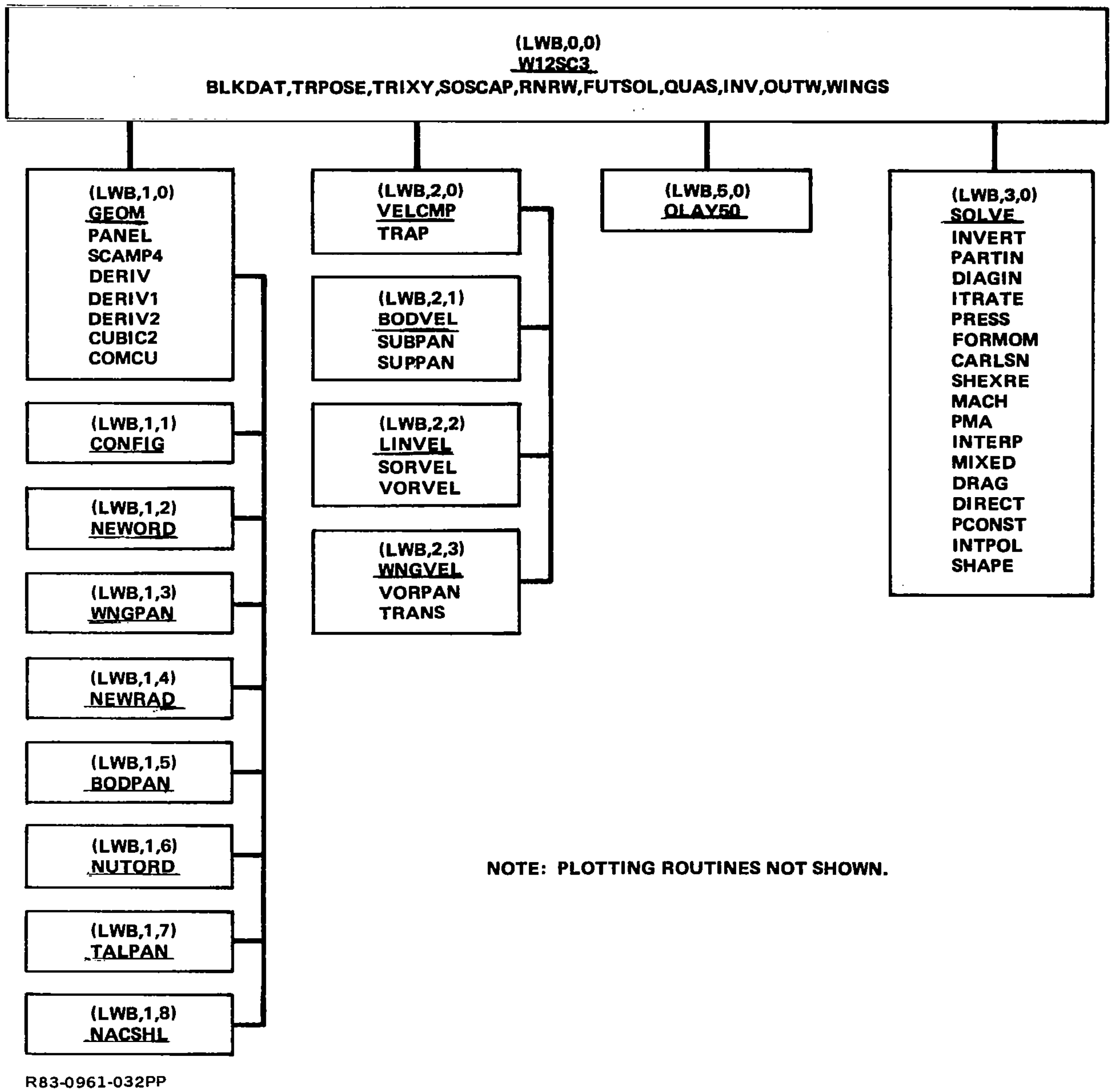


Figure 21. - W12SC3 program overlay structure.

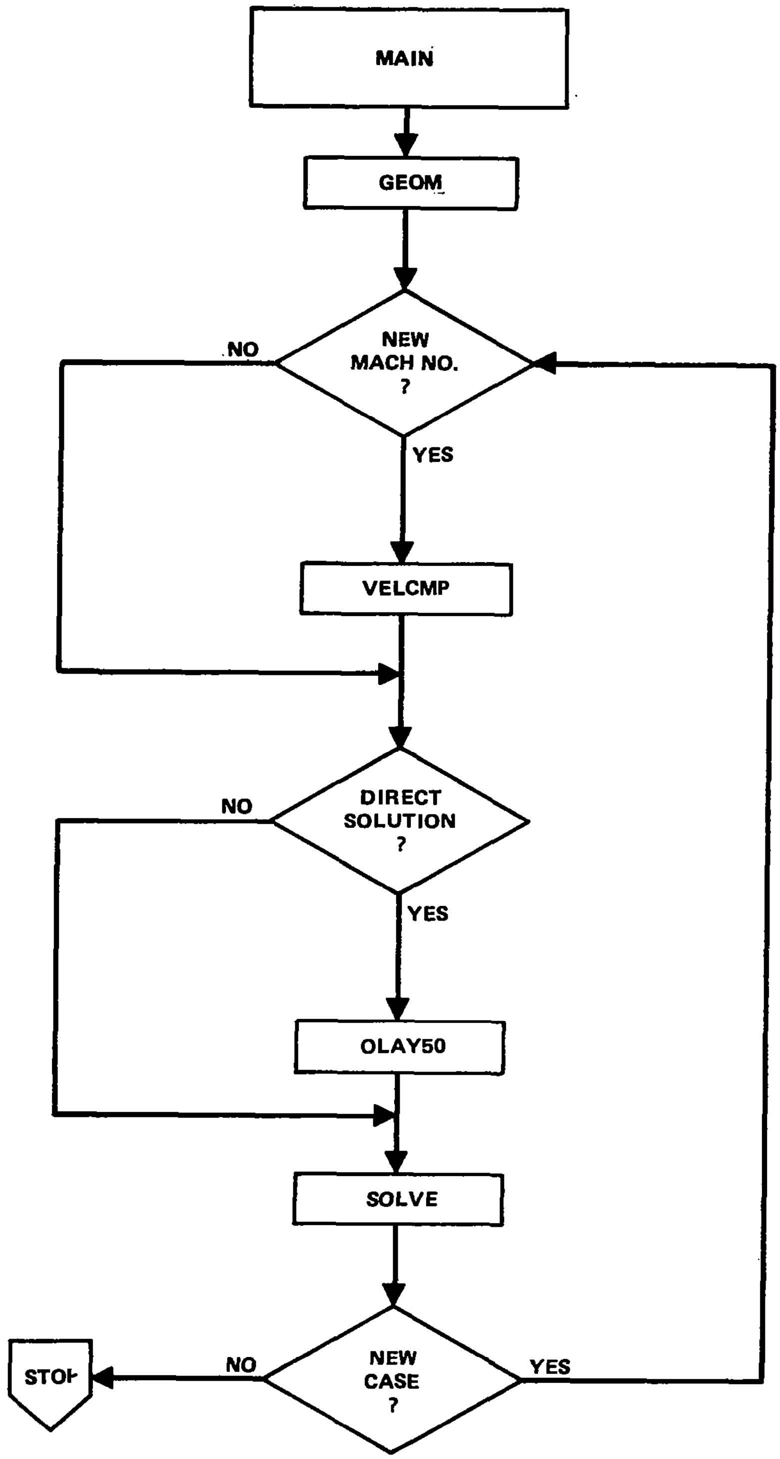


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Figure 22. - W12SC3 program: Overlay Flowchart.

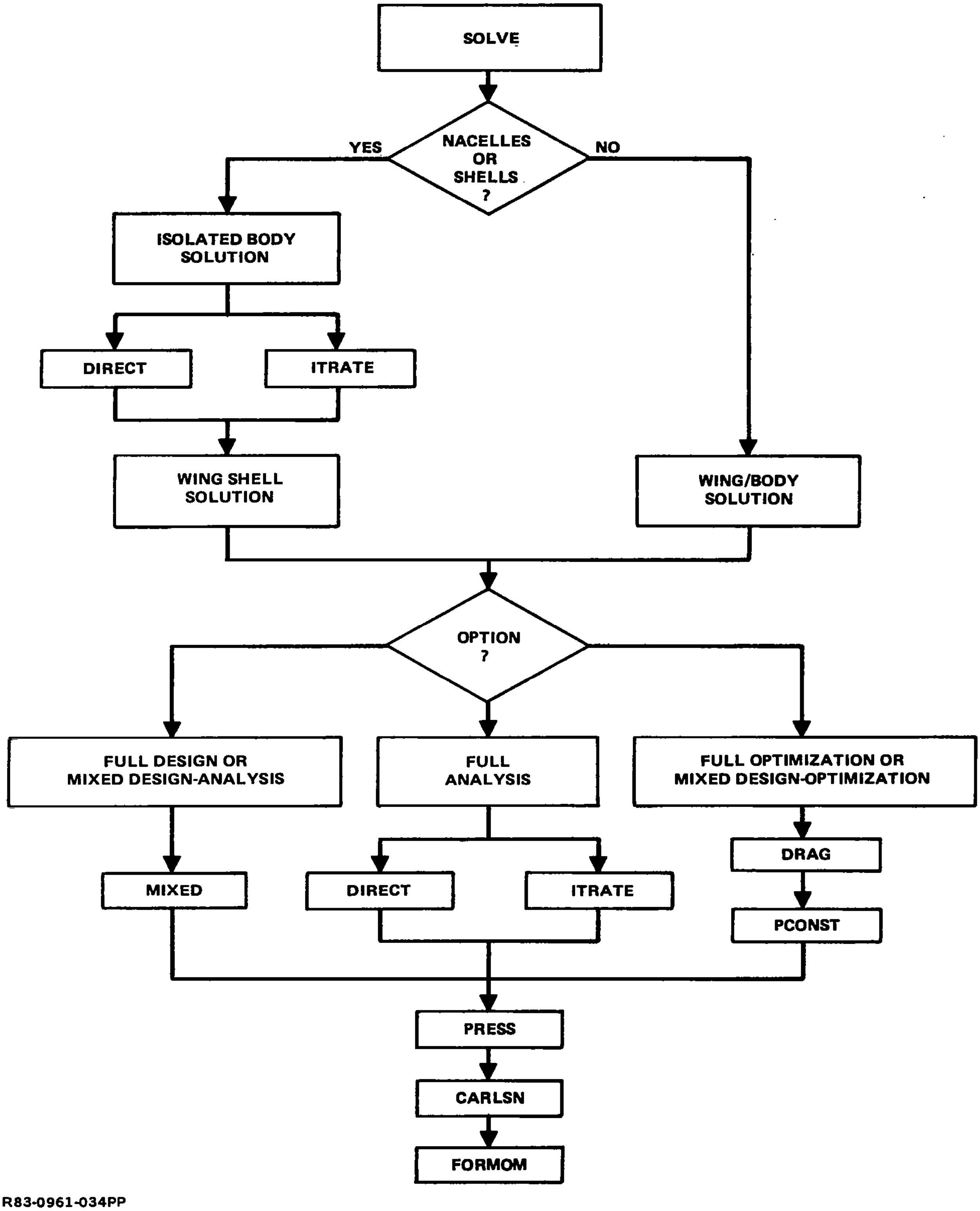



Figure 23. - W12SC3 programs: flowchart for Overlay Solve.

## Design and Optimization Options

Solutions for these cases make use of the matrices formed in overlay OLAY50. For full design or mixed design-analysis cases, the specific solution for a given set of boundary conditions is calculated in subroutine MIXED. This function is performed in subroutine DRAG for full optimization cases and in subroutines DRAG and PCONST for mixed design-optimization cases.

These options require the use of constant-strength vortex panels. The influence coefficients for such panels were already being calculated in the process of forming linearly varying vortex panel influence coefficients, and hence were easily extracted from subroutine VORVEL.

## Conical Design and Optimization Options

These options required small modifications to subroutines MIXED and PCONST.

## Carlson Correction

Subroutines CARLSN, SHEXRE, MACH, and PMA handle the calculation of this nonlinear correction to supersonic wing calculations. Modifications to subroutine FORMOM were required in order to obtain forces and moments with and without the Carlson Correction.

## Interference Shell

Overlay NACSHL was added and is used to calculate shell (and additional wing) panel geometry. Existing wing routines were modified and are used for all further shell calculations. This procedure was simplified with the addition of subroutine WINGS - wing and shell geometric and aerodynamic information is stored on out-of-core files, and one call to WINGS loads or unloads the required information depending upon whether wing or shell calculations are being made.

Other major code changes to accommodate the interference shell capability were required. Overlays VELCMP and SOLVE and subroutines PRESS, FORMOM, MIXED,

and DRAG were modified to properly handle both wing/body and wing/body/shell influence coefficient calculations, boundary condition specifications, and analysis, design, or optimization solutions, as well as velocity, pressure, and force and moment calculations.

In summary, the W12SC3 program differs from the USSAERO "B" program in the following respects:

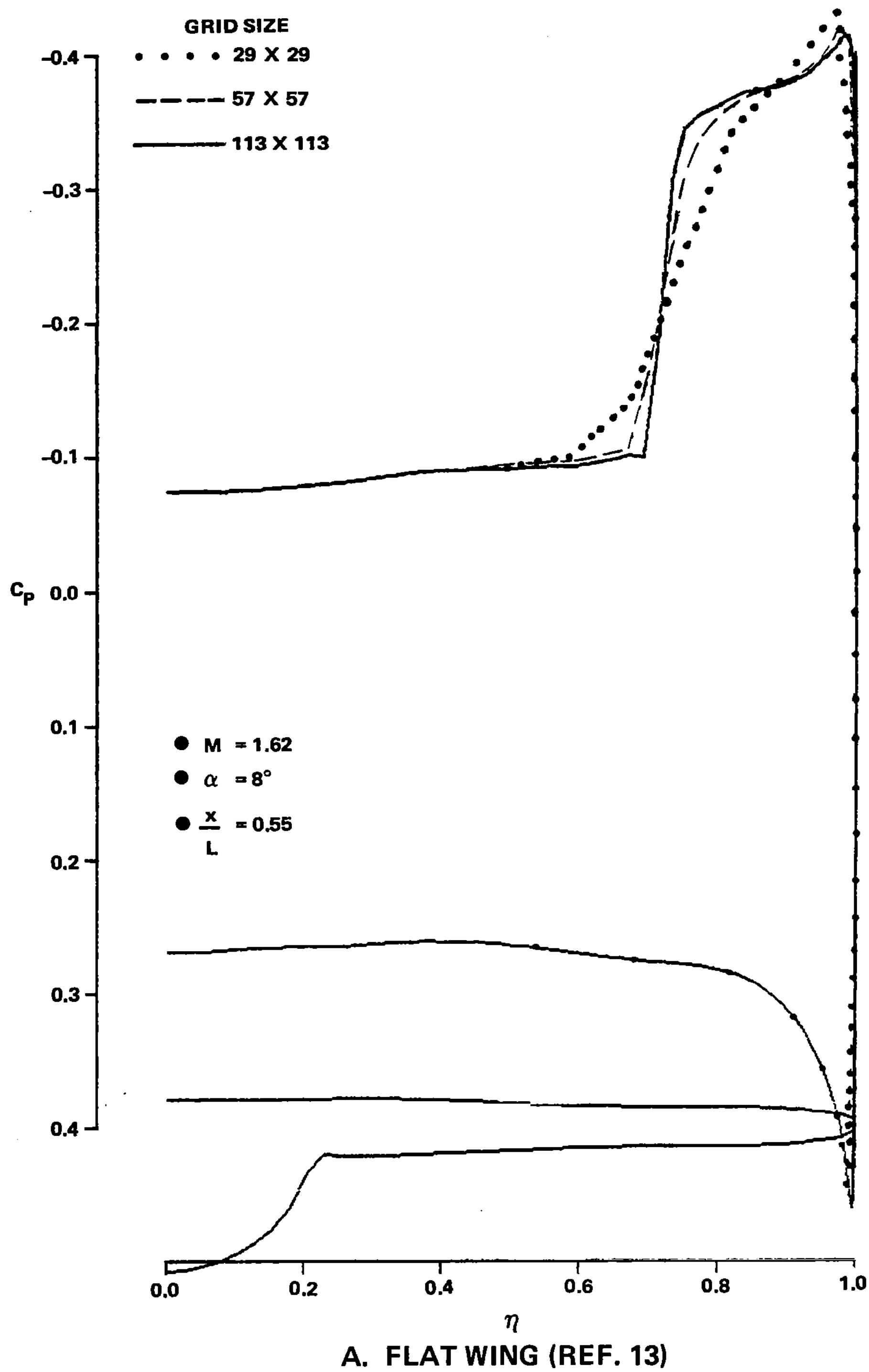
- Problem solving capability
  - Full analysis, design, or optimization
  - Mixed or conical design-analysis
  - Mixed or conical design-optimization
- Solution Method
  - Iterative (full analysis only), or
  - Direct matrix inversion
- Carlson Correction for wing pressures
- Optional interference shell capability.

## COMPUTER REQUIREMENTS

### Core Size

COREL requires $164K_8$ bytes of core storage on the CDC CYBER 175. The size of the core is controlled by the six 60 x 60 arrays used in obtaining the flow-field. If a denser mesh is desired, storage will increase in direct proportion to the increase in storage required for these large arrays. Meshes as large as 113 x 113 have been used to check the dependence of the solution on the mesh density, and the study showed a slight dependence on the grid density around the crossflow recompression location on the upper surface. However, the 60 x 60 grid is appropriate for engineering work as shown in figure 24.

The W12SC3 code requires $265K_8$ bytes with core storage on the CDC CYBER 175. The size of the code is considerably larger than the original USSAERO code due to the numerous options added. The primary increase in core size occurs due to the additional code included in the main overlay, which is now $224K_8$, and overlay (3,0), program SOLVE. Overlay (3,0) adds an additional $28K_8$ to the core require-




A. FLAT WING (REF. 13)

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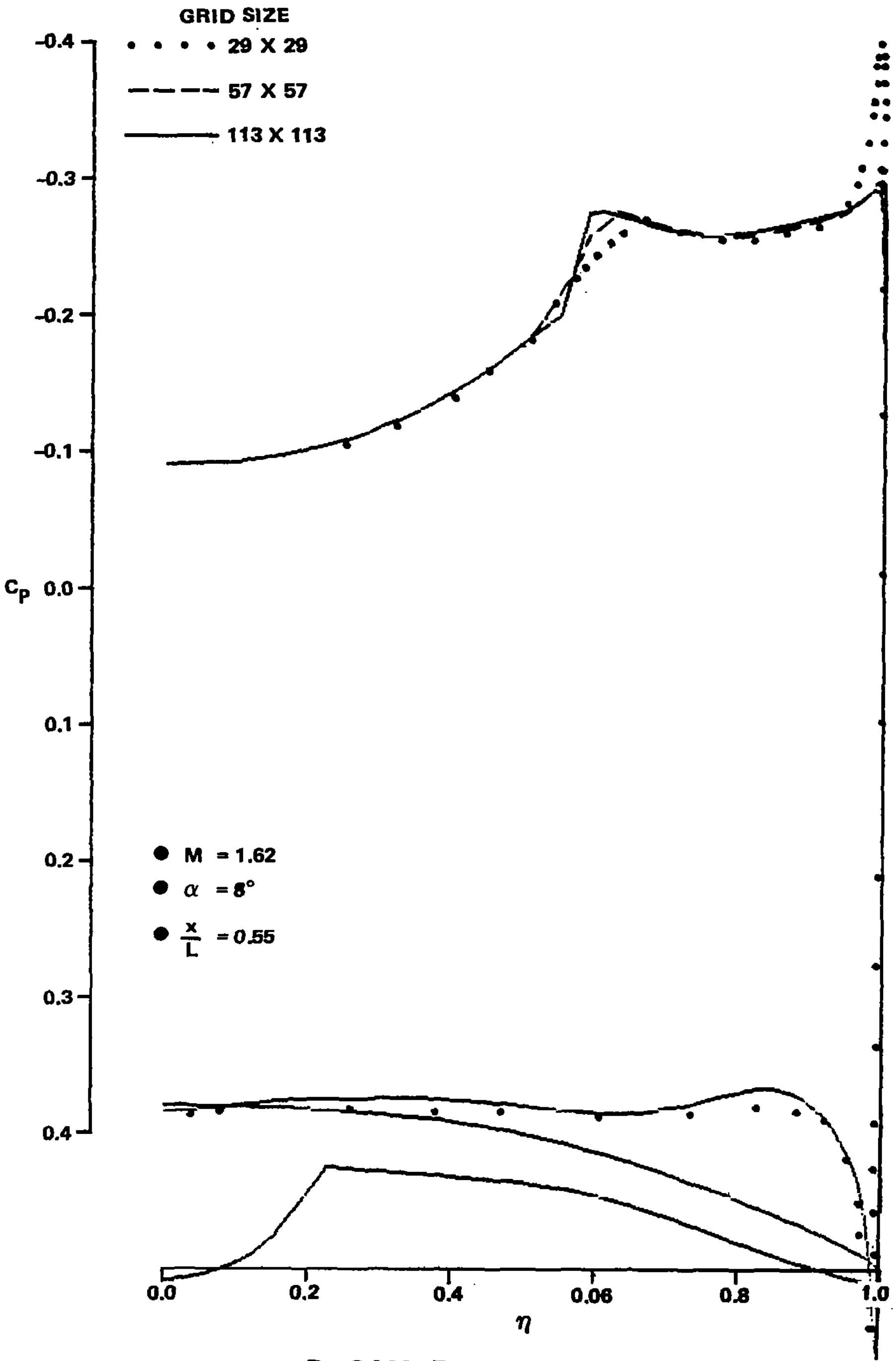
Figure 24. - Effect of mesh density on COREL solution.




B. CAMBERED WING (REF. 13)

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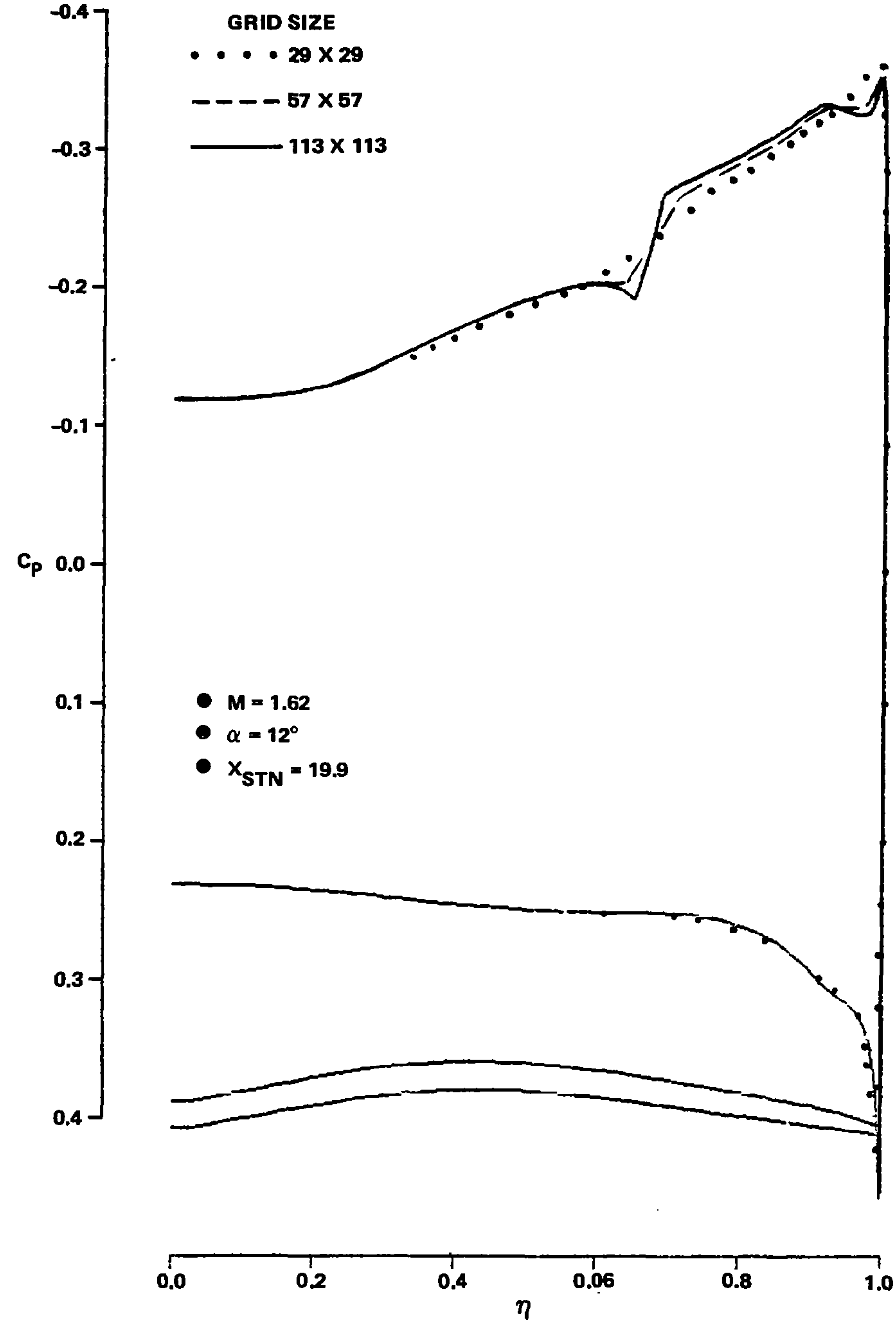
Figure 24. - Continued.




C. DEMONSTRATION WING (REF. 15)

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Figure 24. - Concluded.

ment. The addition of some overlays in SOLVE could reduce the storage by at least $10K_8$ to $15K_8$ bytes. In addition, some additional plotting was added which adds to the core requirements.

## Execution Time

The COREL execution time is based on the time per grid point per iteration. The solution is obtained by an iteration which converges only slowly to the correct answer. It is difficult to determine exactly how many iterations are "enough" for a particular case. Figure 25 provides an example of the change of solution with iterations. Three hundred crude grid (29 x 29; known as 30 x 30) and seventy-five fine (57 x 57; known as 60 x 60) grid iterations should be enough for most cases. Typical running times are:

| Crude Grid Iterations | Fine Grid Iterations | CPU Time, sec CYBER 740 | $C_L$ | $C_D$ |
|---|---|---|---|---|
| 300 | 50 | 90.7 | 0.4549 | 0.06847 |
| 300 | 100 | 117.8 | 0.4546 | 0.06852 |
| 300 | 150 | 143.2 | 0.4544 | 0.06852 |
| 300 | 200 | 164.1 | 0.4542 | 0.06852 |
| 300 | 250 | 192.3 | 0.4542 | 0.06852 |
| 200 | 100 | 103.7 | 0.4539 | 0.06814 |
| 400 | 100 | 131.5 | 0.4549 | 0.06858 |

The times can vary for different cases due to changing location of the bow shock. Although a 60 x 60 grid is specified, however, after the first 50 iterations the solution iteration stops when the bow shock is reached. This means that the effective grid is actually 60 x 40 for most cases.

The WI2SC3 code execution time depends on the number of panels used and the type of solution requested. The iterative solution is usually faster for a single angle-of-attack, but is repeated for each angle-of-attack. The inverse of the AIC matrix is saved after the initial angle-of-attack solution when the direct solution option is used, reducing the cost of additional angles-of-attack

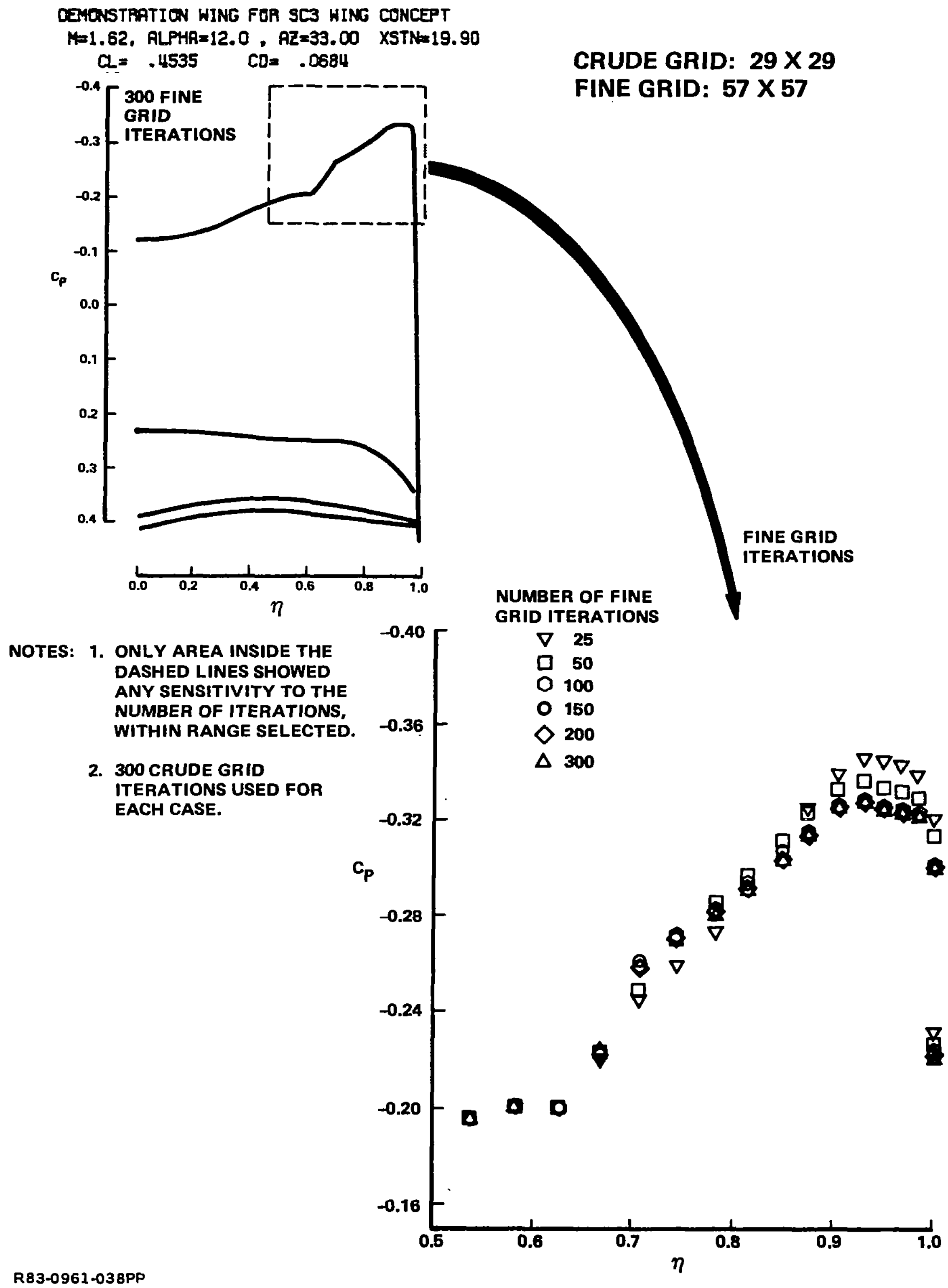


Figure 25. - Effect of number of iterations on COREL solution.

results. Surprisingly, the calculation of the influence coefficients is one of the most time-consuming steps in the calculation, being directly proportional to $N^2$. For an isolated wing, modeled with 380 wing panels, the execution time is divided as follows:

| Case A) | Grumman CYBER 740 | NASA LaRC CYBER 175 |
|---|---|---|
| 1. Influence Coefficients | 430 | 234 |
| 2. Iterative Analysis | 110 | 60 |
| 3. Direct Analysis | 480 | 220 |
| 4. Conical Panel Mixed Design-Analysis | 110 | 60 |
| 5. Conical Panel Mixed Design-Optimization | 190 | 92 |
| Total CPU seconds: | 1320 | 666 |

| Case B) | Grumman CYBER 740 |
|---|---|
| 1. Influence Coefficients | 430 |
| 2. Full Optimization | 660 |
| 3. Direct Analysis | 480 |
| 4. Direct Analysis | 90 |
| 5. Direct Analysis | 90 |
| 6. Direct Analysis | 90 |
| Total CPU seconds: | 1840 |

For a wing-body calculation, the following case provides typical execution times using 140 wing panels, 232 body panels, and 168 panels for the interference shell:

| | Grumman CYBER 740 | |
|---|---|---|
| Case A) | No Shell | Shell |
| Influence Coefficient | 250 | 350 |
| Direct Analysis | 200 | 230 |
| Direct Analysis | 40 | 70 |
| Total CPU seconds: | 490 | 650 |

| Case B) | NASA LaRC CYBER 175 No Shell | Shell |
|---|---|---|
| Influence Coefficient | 136 | 194 |
| Iterative Analysis | 22 | 42 |
| Iterative Analysis | 22 | 42 |
| Total CPU seconds: | 180 | 278 |

The codes have also been run on a number of different CDC computers, and the differences in CPU times are useful in comparing quoted execution times on different machines. For these two codes the results are given in the folowing chart:

| CDC Computer | CPU Time, sec Code COREL | W12SC3 |
|---|---|---|
| 172 | 1345 | 1421 |
| 174 | 1077 | 1087 |
| 740 | 235 | 308 |
| 750 | 162 | 219 |
| 760 | 111 | 150 |

## Sample JCL

The COREL and W12SC3 codes can be run "back to back" or separately depending on the information desired. The sample JCL given below is from a NASA Langley execution, and the link between the codes is the data set passed on unit 32. As shown, the binary forms of the codes are used. The source code is stored at Langley in the UPDATE format, which is convenient for batch-type code modification and is a common utility available on all CDC type machines.

If W12SC3 is being executed in a standalone mode, then INPUT should be copied to TAPE5.

The following sample JCL for the NASA Langley CYBER 175, NOS System illustrates the extremely simple JCL required for execution.

```
GACSMW,T2770,CM265000.
USER,5660782.
CHARGE,XXXXXXX,LRC.
GET(LGO=CRLBIN)
LOAD,LGO.
EXECUTE.
RETURN,LGO.
REWIND,TAPE32.
GET(LGO=W12BIN)
COPY,TAPE32,TAPE5.
REWIND,TAPE5.
LOAD,LGO.
EXECUTE.
EXIT.
```

## INPUT DESCRIPTION

The input data is structured to allow the user the maximum flexibility. The information required to run the programs is divided into three parts. In order to run the two codes together, or each independently, the input information required is collected as follows (and in the order given):

| Combined COREL/W12SC3 | COREL Alone | W12SC3 Alone |
|---|---|---|
| 1. COREL Input | 1. COREL Input | 1. Craidon Geometry |
| 2. Craidon Geometry | 2. Craidon Geometry (optionally) | 2. W12SC3 Input |
| 3. W12SC3 Input | | |

During a combined code execution COREL appends conical panel pressure data to the W12SC3 input. However, the user has to provide the other information contained in that section.

The main control for using the various COREL geometry options is best explained before describing the input in detail. The NAMELIST for COREL includes the following control:

A. If IRPTS = 1 A spanwise section is read from the input
= 0 No spanwise section is read in.

B. If IEQV = 1 The Craidon geometry section is read from input and the spanwise section data is extracted and used to make an adjustment to the conical flow solution to account for the nonconical geometry

= 0 The Craidon geometry is <u>not</u> read in.

C. If IEQV3 = 0 Do <u>not</u> use spanwise section extracted from Craidon geometry for analysis, but only for the nonconical correction

= 1 Use the spanwise section extracted from Craidon geometry for the COREL analysis as well as for the nonconical correction.

This allows the user to employ the Craidon geometry for either the entire analysis or just for the non-conical correction.

In addition, when W12SC3 is executed as part of a combined COREL/W12SC3 run, the first card in the W12SC3 input must contain the word AERO in the first four spaces, and the AEROIN NAMELIST must contain the word END in spaces 3-5. These keywords are used in the COREL subroutines START and GEOMIN to copy the Craidon and W12SC3 input data sets to Unit 32. The W12SC3 data set is then completed in subroutine OUTP.

The combined code execution allows for only a single design point analysis (one spanwise section at one angle-of-attack). However, the W12SC3 code can run a series of cases when executed in a standalone mode. A new AEROIN NAMELIST is required for each new case.

## <u>COREL Input Instructions*</u>

1. 2 CARD TITLE
   for CASE
2. NAMELIST: <u>INPUT</u>

Namelist:** the control of the COREL portion of the program is handled via a Namelist with the name INPUT. The default values reflect a "baseline" computation that has been found through experience to be generally satisfactory. Only

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*,**See footnotes, next page.

those parameters that are to be changed from the default values need to be read in. The Namelist variables, with default values, are listed below:

| Variable | Default | Remarks |
|---|---|---|
| **Combined Code Control Clue** | | |
| KCCC | 0 | = 0 - Complete solution<br>= 1 - COREL solution only |
| **Flow Conditions** | | |
| EMINF | 1.60 | Freestream Mach number |
| ALP | $5^{o}$ | Angle-of-attack |
| GAMMA | 1.4 | Ratio of specific heats |
| **Geometry** | | |
| ETADR | 0.0 | Dividing ray for split between super-critical conical panel and rest of planform (specified as a fraction of the spanwise section) |
| TEWSP | 0.0 | Trailing edge sweep for COREL alone calculation of lift (gives the arrow wing lift) |
| IRPTS | 0 | =0, spanwise section is not input explicitly. Section is either generated internally using options described below or |

---

* Note that COREL uses a nonstandard coordinate system, so that X is the spanwise variable. This is consistent with the coding for COREL. For those variables associated with the actual planform geometry, standard airplane coordinate system nomenclature is used. Thus XSTN, XORIGC, YORIGC, XROOT, and YWNGRT refer to the normal aircraft coordinate system (consistent with the Craidon geometry code). Variables used for the spanwise section definition and modification refer to the COREL coordinate system. While appearing confusing, the use of the code with this system is straightforward in practice.

** Input data using NAMELIST must satisfy the following rules:

1. The first column on each card must be blank.
2. The first item must be the NAMELIST NAME preceded by a $; i.e, $INPUT followed by a blank.
3. Data is input in the form variable = constant, each item being separated by commas; i.e., IC = 30, AZ = 33.0, ...
4. The last item must be $END.
5. The $ above is for CDC; on IBM, the character is &.

| Variable | Default | Remarks |
| --- | --- | --- |
| | | extracted from Craidon geometry input =1, spanwise section input as $X/X_{LE}$, $Y/X_{LE}$ pairs |
| NG | 199 | Number of points defining the internally generated spanwise section (should be odd, NG=199 max) |
| AZ | 33 | Included angle of leading edge of conical shape being analyzed (wing or fuselage) $AZ = 90^{o}-\Lambda_{LE}$, in degrees |
| BZ | 1.5 | For internally generated spanwise sections, BZ sets the section thickness by specifying the half-angle of the centerline section (in degrees) |
| LC | 0 | Camber line clue for internally generated sections<br>= 0, No camber<br>= 1, Circular arc<br>= 2, Elliptical arc<br>= 3, Circular cap<br>= 4, Simple flap |
| CC (dimensioned variable) | 0.0 | Camber line control (see internal geometry generation input section) |
| LT | 1 | Thickness envelope clue for internally generated sections<br>= 0, Circular<br>= 1, Ellipse<br>= 2, Super Ellipse |
| CT (dimensioned variable) | 0.0 | Thickness envelope control (see internal geometry generation input section) |
| LM | 0 | Not used |
| CM (dimensioned variable) | 0.0 | Not used |
| IEQV | 0 | = 0 Do not read Craidon Data Set<br>= 1 Read Craidon Data Set and perform equivalent conical section analysis |

| Variable | Default | Remarks |
|---|---|---|
| IEQV3 | 0 | = 0 Use spanwise section extracted from Craidon data set for nonconical correction calculation only. Spanwise section for COREL analysis is explicitly read in or internally generated<br><br>= 1 Use spanwise section extracted from Craidon Data Set for COREL analysis also. |
| XSTN | 1.0 | X station at which the section is extracted from the Craidon geometry data and the COREL analysis and equivalent conical section analysis are performed |
| XORIGC | 0.0 | X origin of conicity for section extracted from Craidon data set |
| YORIGC | 0.0 | Y origin of conicity for section extracted from Craidon data set |
| XROOT | $1.0 \times 10^6$ | The maximum value of the root chord (to prevent the use of Craidon data off the planform) |
| ZROOT | 0.0 | The elevation of the origin of the conical calculation |
| YWNGRT | -1.0 | The trailing edge location for the calculation of non-conical correction when XSTN is greater than XROOT |
| IMOD | 0 | Clue for the addition of a local "cubic" bump on spanwise section (actually 6th order).<br>= 0 No local section modification<br>= 1 Upper surface modification<br>= 2 Lower surface modification<br>= 3 Both upper and lower surface modification |
| XU1 | 0.0 | Inboard end of section modification on upper surface (as a fraction of spanwise section) |
| XU2 | 0.0 | Location of maximum thickness position of position of modification on upper surface (as a fraction of spanwise section) |

| Variable | Default | Remarks |
|---|---|---|
| XU3 | 0.0 | Outboard end of modification on upper surface (as a fraction of spanwise section) |
| DTCU | 0.0 | Magnitude of upper surface bump in percent of semi-span |
| XL1 | 0.0 | Inboard end of section modification on lower surface (as a fraction of spanwise section) |
| XL2 | 0.0 | Location of maximum thickness position of modification on lower surface (as a fraction of spanwise section) |
| XL3 | 0.0 | Outboard end of modification on lower surface (as a fraction of spanwise section) |
| DTCL | 0.0 | Magnitude of lower surface bump in percent of semi-span. A positive value reduces the thickness on the lower surface. |

Output Options

| | | |
|---|---|---|
| IOUT | 1 | = 0 Full output everywhere in flowfield.<br>= 1 Output on surface only |
| IOUT2 | 0 | = 0 No further abbreviation of output<br>= 2 Very brief "terminal" output suitable for online running |
| IPUNCH | 0 | = 0 Generated section not punched<br>= 1 Generated section is punched (Unit 8)<br>= 3 The solution data is punched. Data includes Mach, alpha, XSTN, $C_N$, $C_N$-nonconical, and spanwise section and pressures, as $X/X_{LE}$, $Y/X_{LE}$, $C_p$, $C_p$ (nonconical correction) (All output is in F10 format on Unit 7) |
| IPLOT | 1 | = 0 Don't plot results<br>= 1 Call graphics routine (dummy in Langley version).<br>= 2 Plot output is punched, in the forms X, Y, $C_p$ |

| Variable | Default | Remarks |
|---|---|---|
| Numerical Solution | | |
| IC | 30 | Initial grid in $\theta$ direction (around body ring) |
| JC | 30 | Initial grid in r direction (away from body column) |
| KREF | 2 | Number of grids (presently a max of 2) |
| KMAX (dimensioned variable) | 300<br>150 | Maximum number of iterations for each successive grid |
| W(3) | 1.0<br>1.5 | Overrelaxation factor, successive grids |
| DMIN (dimensioned variable) | 1.E-6<br>1.E-6 | Convergence criteria on each successive grid |
| EST | -6.0 | Coefficient of $\phi_{st}$, damping term |
| NSHKR | 10 | Approximate number of mesh points between shock position and grid boundary |
| KSHKR | 8 | Number of smoothings of refined shock location |
| JDRLX | 6 | Ring and column relaxation split |
| EPSHKI | 1.2 | EP in SHOCKI, parameter for initial estimate of bow shock location. EPSHKI is a multiple of the Mach angle |
| Available Unused Items | | |
| IDESIN, KDESMX, WDES | | Intended for use with any design package, dummy in present code |

END OF NAMELIST

## Spanwise Section Input Block

| Card No. | Format | Field | Name | Remarks |
|---|---|---|---|---|
| A1 | Literal | | TITLE | 80 characters describing spanwise section definition |
| A2 | 7F10.0 | 1 | ZSYM | Section symmetry clue, if ZSYM = 1.0 section is symmetric; read upper surface only. = 0, section is asymmetrical, both upper and lower surface read in |
| | | 2 | THICK | Section thickness. YU, YL ordinates multiplied by THICK. If = 0, THICK is reset to 1.0, and input section inputs are unchanged |
| | | 3 | FNU | Number of ordinate pairs defining upper surface |
| | | 4 | FNL | Number of ordinate pairs defining lower surface |
| | | 5 | XKSMTH | Dummy variable, intended to be the number of section smoothings if smoothing is incorporated |
| | | 6 | XSING | X location of singularity for mapping |
| | | 7 | YSING | Y location of singularity for mapping |

NOTE: The X, Y location of the mapping singularity should be specified at the midpoint of a line drawn between the center of the leading edge radius and the leading edge. If XSING=0, the program estimates this position internally.

| Card No. | Format | Field | Name | Remarks |
|---|---|---|---|---|
| A3 | Literal | | TITL | 80 character describes upper surface of sections |
| A4 | 7F10.0 | 1 | XU | Upper surface X coordinate |
| | | 2 | YU | Upper surface Y coordinate |

The ordinates are multiplied by tan AZ internally to convert from normalized to physical values.

NOTE: Repeat card A4 FNU times.

| Card No. | Format | Field | Name | Remarks |
|---|---|---|---|---|

The section is input starting at the leading edge, $X/X_{LE} = 1$, and proceeds to the root, $X/X_{LE} = 0$.

| | | | | |
|---|---|---|---|---|
| A5 | Literal | | TITL | 80 characters describing the lower surface |

If FSYM = 1, skip card A6

| | | | | |
|---|---|---|---|---|
| A6 | 7F10.0 | 1 | XL<br>YL | Lower surface X coordinate<br>Lower surface Y coordinate |

NOTE: Repeat card A6 FNL times.

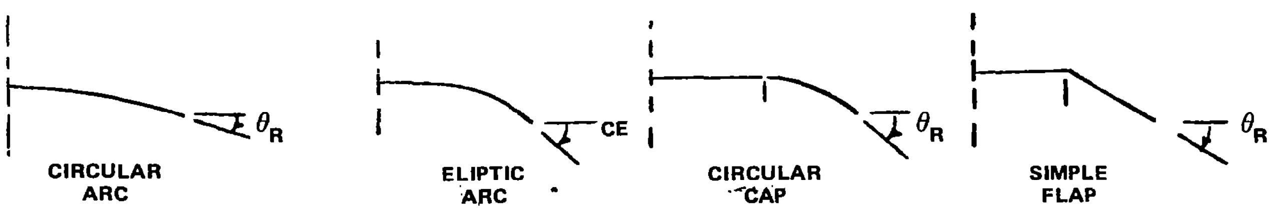
The leading edge point should be the same for both the upper surface and the lower surface.

Description of Internal Geometry Generation Parameters Used In Namelist

1. CAMBER

| | |
|---|---|
| LC = 0 No Camber | CC(1) = CC(2) = CC(3) = 0 |
| = 1 Circular Arc | CC(1) = $\theta_R$ CC(2) = CC(3) = 0 |
| = 2 Elliptic Arc | CC(1) = $\theta_r$ (curvature), CC(2) = CE (leading edge angle), CC(3)=0 |
| = 3 Circ. Cap | CC(1) = $\theta_R$ (1.e. angle), CC(2) = 0, CC(3) = ($x_c$/C) |
| = 4 Split | CC(1) = $\theta_R$, CC(2) = 0, CC(3) = $x_c$/C |

NOTE: CC(4), CC(5) not operational, but available.




2. THICKNESS

| | | |
|---|---|---|
| LT = 0 | Circular Cone | CT(1) = CT(2) = 0 |
| = 1 | Elliptic Cone | CT(1) = CT(2) = 0 |
| = 2 | Super Elliptic | CT(1) = -4., CT(2) = exponent -2 of $\left(\frac{Y}{B}\right)$ |
| | | CT(3) = exponent -2 of $\left(\frac{X}{A}\right)$ |

e.g., the super ellipse is given by

$$\left(\frac{X}{A}\right)^{2+CT(3)} + \left(\frac{Y}{B}\right)^{2+CT(2)} = 1$$

CT(2) = CT(3) = 1 for "pure" super ellipse.

## Craidon Geometry Definition

The Craidon geometry definition section is required for COREL alone runs when IEQV = 1 (see COREL input description), as well as for combined COREL/W12SC3 and W12SC3 alone runs. When required for COREL alone and and combined COREL/W12SC3 runs, the Craidon geometry follows the COREL data inputs. When W12SC3 is executed alone, the Craidon geometry definition is the first section of the input data.

The input to the W12SC3 program consists of two parts: the numerical description of the initial configuration geometry (Craidon); and the W12SC3 input data which specifies the singularity paneling scheme, program options, Mach number, angle-of-attack, and any additional input data required for particular program options.

The configuration is defined to be symmetrical about the x-z plane; therefore only one side (the positive y side) of the configuration need be described. The coordinate system notation is shown in figure 26.

| Columns | Variable | Value | Description |
|---|---|---|---|
| 1-80 | TITLE1 | | This card contains any desired idenifying information. |
| | | Control Integers | |
| 1-3 | J0 | 0 | No reference area |
| | | 1 | Reference area to be read |
| 4-6 | J1 | 0 | No wing data |
| | | 1 | Cambered wing data to be read |
| | | -1 | Uncambered wing data to be read |

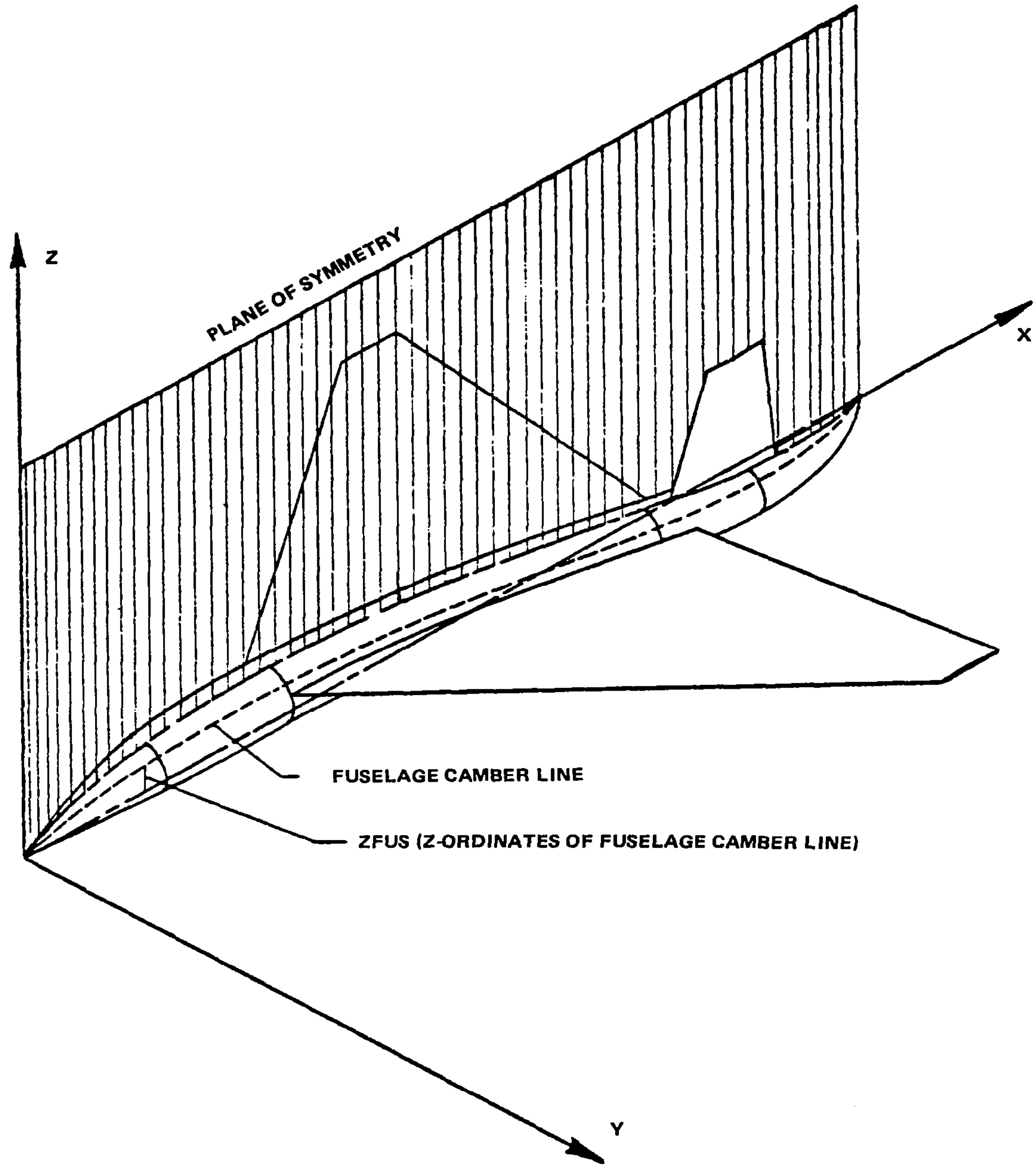



Figure 26. - Coordinate system for craidon geometry (from NASA CR 3228, 1980).

| Columns | Variable | Value | Description |
|---|---|---|---|
| 7-9 | J2 | 0 | No fuselage data. |
| | | 1 | Data for arbitrarily shaped fuselage to be read. |
| | | -1 | Data for circular fuselage to be read. (With J6 = 0, fuselage will be cambered. With J6 = -1, fuselage will be symmetrical with respect to the xy-plane. With J6 = 1, entire configuration will be symmetrical with respect to the xy-plane.) |
| 10-12 | J3 | 0 | No Pod data. |
| | | 1 | Pod data to be read.* |
| 13-15 | J4 | 0 | No fin (vertical tail) data. |
| | | 1 | Fin data to be read. |
| 16-18 | J5 | 0 | No canard (horizontal tail) data |
| | | 1 | Canard data to be read. |
| 19-21 | J6 | 0 | A cambered circular or arbitrary fuselage if J2 is non-zero. |
| | | 1 | Complete configuration is symmetrical with respect to the xy-plane, which implies an uncambered circular fuselage, if there is one. |
| | | -1 | Uncambered circular fuselage with J2 non-zero. |
| 22-24 | NWAF | 2-20 | Number of airfoil sections used to describe the wing. |
| 25-27 | NWAFOR | 3-30 | Number of ordinates used to define each wing airfoil section. If the value of |

NWAFOR is input with a negative sign, the program will expect to read lower surface ordinates also; otherwise, the airfoil is assumed to be symmetrical.

| Columns | Variable | Value | Description |
|---|---|---|---|
| 28-30 | NUFUS | 1-4 | Number of fuselage segments. |
| 31-33 | NRADX(1) | 3-20 | Number of points used to represent half-section of first fuselage segment. If fuselage is circular, the program computes the indicated number of Y- and Z-coordinates. |
| 34-36 | NFORX(1) | 2-30 | Number of stations for first fuselage segment. |

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* W12SC3 will read input data for pods, but will not use them in the panel model.

| Columns | Variable | Value | Description |
|---|---|---|---|
| 37-39 | NRADX(2) | 3-20 | Same as NRADX(1), but for the second fuselage segment. |
| 40-42 | NFORX(2) | 2-30 | Same as NFORX(1), but for the second fuselage segment. |
| 43-45 | NRADX(3) | 3-20 | Same as NRADX(1), but for the third fuselage segment. |
| 46-48 | NFORX(3) | 2-30 | Same as NFORX(1), but for the third fuselage segment. |
| 49-51 | NRADX(4) | 3-20 | Same as NRADX(1), but for the fourth fuselage segment. |
| 52-54 | NFORX(4) | 2-30 | Same as NFORX(1), but for the fourth fuselage segment. |
| 55-57 | NP | 0-9 | Number of Pods.* |
| 58-60 | NPODOR | 4-30 | Number of stations at which pod radii are to be specified.* |
| 61-63 | NF | 0-6 | Number of fins (vertical tails) to be described. |
| 64-66 | NFINOR | 3-10 | Number of ordinates used to describe each fin airfoil section. |
| 67-69 | NCAN | 0-6 | Number of canards (horizontal tails) to be described. |
| 70-72 | NCANOR | 3-10 | Number of ordinates used to define each canard airfoil section. If the value of NCANOR is negative, the program will expect to read lower surface ordinates also; otherwise, the airfoil is assumed to be symmetrical. |
| | | | Reference Area |
| 1-7 | REFA | | Reference Area Card. This is the planform 1/2 area in W12SC3. |

-------
* W12SC3 will read input data for pods, but will not use them in the panel model.

| Columns | Variable | Value | Description |
|---|---|---|---|
| | | | **Wing** |
| 1-7 | XAF | | Cards, each containing up to 10 values of percent chord, at which ordinates of airfoils are to be specified. Total of NWAFOR values. Each card may be identified in columns 73-80 by XAFJ, where J denotes the last location specified on that card. |
| <br>1-7<br>8-14<br>15-21<br>22-28 | WAFORG | | NWAF cards, each containing values of:<br>X-coordinate of wing airfoil leading edge,<br>Y-coordinate of wing airfoil leading edge,<br>Z-coordinate of wing airfoil leading edge,<br>Wing airfoil streamwise chord length. Each card may be identified in columns 73-80 by WAFORGJ, where J denotes the airfoil number, starting from the most inboard airfoil. |
| <br>1-7 | TZORD | | NWAF cards, each containing up to 10 values of DELTAZ (mean 8-14 camber line). A total of NWAFOR values will be read per airfoil.<br>Each card may be identified in denotes the last location on that card. These values will be input only if J1 = 1. |
| 1-7<br>8-14<br>etc | WAFORD | | Cards, each containing up to 10 values of wing half-thickness, (each specified as percent of the chord) specified for each wing airfoil. If NWAFOR < 0, the same number of values will be read for the lower surface. |
| | | | **Body (Fuselage)** |
| 1-7<br>8-14<br>etc | XFUS | | Cards, each containing up to 10 values of X-coordinates of body axial stations specified for each body segment. Total number of values per segment is specified by NFORX. Each card may be identified in columns 73-80 by XFUSJ, where J denotes the last location on that card. |
| 1-7<br>8-14<br>etc | ZFUS | | Cards, each containing up to 10 values of Z-ordinates of fuselage camber line, specified at each body axial station. Total number of values per segment is specified by NFORX. Each card may be identified in columns 73-80 by ZFUSJ, where |

| Columns | Variable | Value | Description |
|---|---|---|---|
| | | | J denotes the last location on that card. Input only if cambered circular fuselage. |
| 1-7<br>8-14<br>etc | SFUS | | Cards, each containing up to 10 values of Y-ordinates of half-cross-section points. A total of NRADX values are input. The cards containing NRADX values of Y-coordinates are followed by cards containing the Z-coordinates of the same points.<br>These sets of cards are repeated for each fuselage segment. Input only if fuselage of arbitrary shape. |
| 1-7<br>8-14<br>etc | FUSARD | | Cards, each containing up to 10 values values of fuselage cross-sectional areas. Total of NFORX values will be read per fuselage segment. Each card may be identified in columns 73-80 by FUSARDJ, where J denotes last station specified on that card. Input only if circular fuselage. |
| | | Fin | |
| | FINORG | | |
| 1-7 | | | X-ordinate on inboard airfoil leading edge, |
| 8-14 | | | Y-ordinate on inboard airfoil leading edge, |
| 15-21 | | | Z-ordinate on inboard airfoil leading edge, |
| 22-28 | | | Chord length of inboard airfoil, |
| 29-35 | | | X-ordinate on outboard airfoil leading edge, |
| 36-42 | | | Y-ordinate of outboard airfoil leading edge, |
| 43-49 | | | Z-ordinate of outboard airfoil leading edge, |
| 50-56 | | | Chord length of outboard airfoil.<br>This card may be identified in columns 73-80 by FINORGJ, where J denotes the fin number. |
| 1-7<br>8-14<br>etc | XFIN | | Cards, each containing up to 10 values of fin airfoil percent chord. Each card can be identified in columns 73-80 by XFINJ, where J denotes the fin number. |
| 1-7 | FINORD | | Cards, each containing up to 10 values of fin airfoil half-thickness, expressed in percent chord. Since the fin airfoil must |

| Columns | Variable | Value | Description |
|---|---|---|---|
| | | | be symmetrical, only the ordinates on the positive Y-side of the fin chord plane are required. Each card may be identified in columns 73-80 by FINORDJ, where J denotes the fin number. |

NOTE: FINORG, XFIN and FINORD are input for each fin.

Canard

| Columns | Variable | Value | Description |
|---|---|---|---|
| | CANORG | | |
| 1-7 | | | X-ordinate of inboard airfoil leading edge, |
| 8-14 | | | Y-ordinate of inboard airfoil leading edge |
| 15-21 | | | Z-ordinate of inboard airfoil leading edge, |
| 22-28 | | | Chord length of inboard airfoil. |
| 29-35 | | | X-ordinate of outboard airfoil leading edge, |
| 36-42 | | | Y-ordinate of outboard airfoil leading edge, |
| 43-49 | | | Z-ordinate of outboard airfoil leading edge, |
| 50-56 | | | Chord length of outboard. This card may be identified in columns 73-80 by CANORGJ, where J denotes canard number. |
| 1-7<br>8-14<br>etc | XCAN | | Cards, each containing up to 10 values of canard airfoil percent chord. Each card may be identified in columns 73-80 by XCANJ, where J denotes canard number. Total number of values is NCANOR/airfoil. |
| 1-7<br>8-14<br>etc | CANORD | | Cards, each containing up to 10 values of canard airfoil half-thickness, expressed in percent chord. If canard airfoil is not symmetrical, the lower ordinates are presented on a second CANORD set of cards. The program expect both upper and lower ordinates to be punched as positive values in percent chord. |

NOTE: CANORG, XCAN, and CANORD are input for each canard.

## W12SC3 Input Instructions

The W12SC3 input data is required for combined COREL/W12SC3 and W12SC3 alone runs, and follows the Craidon Geometry Definition. These inputs consist of (1) Title Card, (2) Options Card, (3) Control Integer Card, (4) Ref. Lengths Card, (5) Wing Data Cards, (6) Body Data Cards, (7) Fin Data Cards, (8) Canard Data Cards, (9) Nacelle/Shell Data Cards, (10) Mach Number and Angle-of-Attack Card, and (11) additional input data cards required for particular program options.

### Singularity Paneling Geometry

| Columns | Variable | Value | Description |
|---|---|---|---|
| 1-80 | TITLE2 | | This card contains identifying information. Columns 1-4 should contain the word AERO for combined COREL/W12SC3 runs. |

### Options

| Columns | Variable | Value | Description |
|---|---|---|---|
| 1-3 | LINBC | 0 | Non-planar boundary condition (Subsonic analysis only). |
| | | 1 | Planar boundary condition. |
| 4-6 | THICK | 0 | Do not calculate wing thickness matrix. |
| | | 1 | Calculate wing thickness matrix if LINBC = 1. |
| 7-8 | PRINT | | Print option flag. |
| | | 0 | Print the pressures, the forces and the moments. |
| | | 1 | Print option 0 and print the spanwise loads on the wing, fin and canard. |
| | | 2 | Print option 1 and print the velocity components, source and vortex strengths. |
| | | 3 | Print option 2 and print the steps in the iterative solution. |
| | | 4 | Print option 3 and print the axial and normal velocity matrices. If PRINT$<0$, the panel geometry will be included in the printout. |
| 9-12 | LCPA | blank | Not used. |
| 13-15 | LCPB | blank | Not used. |

| Columns | Variable | Value | Description |
|---|---|---|---|
| 16-18 | ITMETH | | Iterative solution method selection flag. |
| | | 0,2 | Blocked GAUSS-SEIDEL iterative solution procedure. |
| | | 1 | Blocked JACOBI iterative solution procedure. |
| | | 3 | Blocked controlled successive overrelaxation iterative solution procedure. |
| | | 4 | Blocked successive overrelax-ation iterative solution procedure. |
| 19-21 | ITMAX | 0 | Maximum number of iterations set at 50. |
| | | integer | Maximum number of iterations specified. |
| 22-24 | CCTEST | 0 | Convergence criterion set at 0.001. |
| | | real | Convergence criterion specified. |
| 29-35 | DCTEST | 0 | Divergence criterion set at 1000. |
| | | real | Divergence criterion specified. |
| 36-41 | ALF1 | | Relaxation factor>1 |
| 43-49 | ALF2 | | Relaxation factor<1 |

Control Integers

| Columns | Variable | Value | Description |
|---|---|---|---|
| 1-3 | KO | | Reference length flag. |
| | | 0 | No reference length to be read. |
| | | 1 | Reference length to be read. |
| 4-6 | K1 | | Wing definition flag. (K1 must be |
| | | 0 | >0 if wing is to be included in |
| | | 1 | analyses.) No wing data to be read. |
| | | 1 | Wing data follows. Wing has sharp leading edge. |
| | | 3 | Wing data follows. Wing has round leading edge |
| 7-9 | K2 | | Body (fuselage) definition flag. |
| | | 0 | No fuselage data to be read. |
| | | 1 | Fuselage data to be read. |
| 10-12 | K3 | | Pod definition flag (not used). |

| Columns | Variable | Value | Description |
|---|---|---|---|
| 13-15 | K4 | | Fin definition flag. |
| | | 0 | No fin data to be read. |
| | | 1 | Fin data follows. Fin has sharp leading edge. |
| | | 3 | Fin data to be read. Fin has round leading edge. |
| 16-18 | K5 | | Canard (horizontal tail) definition flag. |
| | | 0 | No canard data to be read. |
| | | 1 | Canard data to follow. Canard has sharp leading edge. |
| | | 3 | Canard data follows. Canard has round leading edge. |
| 19-21 | K6 | 0 | No nacelle/shell data to be read |
| | | 1 | Nacelle/shell data to be read. |
| 22-24 | KWAF | 0, 2-20 | Number of wing sections used to define the inboard and outboard outboard panel edges. If KWAF=0, the panel edges are defined by NWAF in geometry input. |
| 24-27 | KWAFOR | 0, 3-30 | Number of ordinates used to define the leading and trailing edges of the wing panels. If KWAFOR=0, the panel edges are defined by NWAFOR in the input geometry. |
| 28-30 | KFUS | | Number of fuselage segments. The program sets KFUS=NFUS. |
| 31-33 | KRADX(1) | 0, 3-20 | Number of meridian lines used to define panel edges of first body segment. There are 3 options for defining the panel edges. If KRADX(1)=0, the meridian lines are define by NRADX(1) in geometry input. If KRADX(1) is positive, the meridian lines are calculated at equally spaced PHIK's. If KRADX(1) is negative, the meridian lines are calculated at specified values of PHIK. |
| 34-36 | KFORX(1) | 0, 2-30 | Number of axial stations used to define leading and trailing edges of panels on first body segment. If KFORX(1)=0, the panel edges are defined by NFORX(1) in the geometry input. |

| Columns | Variable | Value | Description |
|---|---|---|---|
| 37-39 | KRADX(2) | 0, 3-20 | Same as KRADX(1), but for second body segment. |
| 40-42 | KFORX(2) | 0, 2-30 | Same as KFORX(1), but for second body segment. |
| 43-45 | KRADX(3) | 0, 3-20 | Same as KRADX(1), but for third body segment. |
| 46-48 | KFORX(3) | 0, 2-30 | Same as KFORX(1), but for third body segment. |
| 49-51 | KRADX(4) | 0, 3-20 | Same as KRADX(1), but for fourth body segment. |
| 52-54 | KFORX(4) | 0, 2-30 | Same as KFORX(1), but for fourth body segment. |

Additional Revised Configuration Paneling Description Control Integers

| Columns | Variable | Value | Description |
|---|---|---|---|
| 1-3 | KF(1) | 0, 2-20 | Number of fin sections used to define the inboard and outboard panel edges on the first fin. If KF(1)=0, the root and tip chords define the panel edges. |
| 4-6 | KFINOR(1) | 0, 3-30 | Number of ordinates used to the leading and trailing edges of the fin panels on the first fin. If KFINOR(1)=0, the panel edges are defined by NFINOR. |
| 7-9 | KF(2) | 0, 2-20 | Same as for KF(1), but for second fin. |
| 10-12 | KFINOR(2) | 0, 3-30 | Same as for KFINOR(1), but for second fin. |
| 13-15 | KF(3) | 0, 2-20 | Same as for KF(1), but for third fin. |
| 16-18 | KFINOR(3) | 0, 3-30 | Same as for KFINOR(1), but for third fin. |
| 19-21 | KF(4) | 0, 2-20 | Same as for KF(1), but for fourth fin. |
| 22-24 | KFINOR(4) | 0, 3-30 | Same as for KFINOR(1), but for fourth fin. |

| Columns | Variable | Value | Description |
|---|---|---|---|
| 25-27 | KF(5) | 0, 2-20 | Same as for KF(1), but for fifth fin. |
| 28-30 | KFINOR(5) | 0, 3-30 | Same as for KFINOR(1), but for fifth fin. |
| 31-33 | KF(6) | 0, 2-20 | Same as for KF(1), but for sixth fin. |
| 34-36 | KFINOR(6) | 0, 3-30 | Same as for KFINOR(1), but for sixth fin. |
| 37-39 | KCAN(1) | 0, 2-20 | Number of canard sections used to define edges on the first canard. If KCAN(1)=0, the root and tip chords define the panel edges. If KCAN(1) *negative*, no vortex sheets carry through the body and concentrated vortices are shed from the inboard edge of the canard or tail surface. |
| 40-42 | KCANOR(1) | 0, 3-30 | Number of ordinates used to define the leading and trailing edges of the first canard. If KCANOR(1)=0, the panel edges are defined by NCANOR. |
| 43-45 | KCAN(2) | 0, 2-20 | Same as for KCAN(1), but for second canard. |
| 46-48 | KCANOR(2) | 0, 3-30 | Same as for KCANOR(1), but for second canard. |
| 49-51 | KCAN(3) | 0, 2-20 | Same as for KCAN(1), but for third canard. |
| 52-54 | KCANOR(3) | 0, 3-30 | Same as for KCANOR(1), but for third canard. |
| 55-57 | KCAN(4) | 0, 2-20 | Same as for KCAN(1), but for fourth canard. |
| 58-60 | KCANOR(4) | 0, 3-30 | Same as for KCANOR(1), but for fourth canard. |
| 61-63 | KCAN(5) | 0, 2-20 | Same as for KCAN(1), but for fifth canard. |
| 64-66 | KCANOR(5) | 0, 3-30 | Same as for KCANOR(1), but for fifth canard. |

| Columns | Variable | Value | Description |
|---|---|---|---|
| 67-69 | KCAN(6) | 0,<br>2-20 | Same as for KCAN(1), but for sixth canard. |
| 70-72 | KCAN(6) | 0,<br>3-30 | Same as for KCANOR(1), but for sixth canard. |
| REFERENCE LENGTHS: | | This card can be identified with REFL in columns 73-80, and contains the following: | |
| 1-7 | REFAR | | Half-wing reference area. If REFAR = 0, the value of the reference area is defined as the value of REFA in the geometry input. |
| 8-14 | REFB | | Wing semi-span. If REFB = 0, a value of 1.0 is used for the reference semi-span. |
| 15-21 | REFC | | Wing reference chord. If REFC = 0, a value of 1.0 is used for the reference chord. |
| 22-28 | REFD | | Body reference diameter. If REFD = 0, a value of 1.0 is used for the reference diameter. |
| 29-35 | REFL | | Body reference length. If REFL = 0, a value of 1.0 is used for the reference length. |
| 36-42 | REFX | | X-coordinate of moment center. |
| 43-49 | REFZ | | Z-coordinate of moment center. |

Wing

| Columns | Variable | Value | Description |
|---|---|---|---|
| 1-7<br>8-14<br>etc | RHO | | Cards containing NWAF values of wing leading edge radius expressed in percent of the chord. Required only if K1 = 3. It may be identified in columns 73-80 by RHOJ, where J denotes the number of the last radius given on that card. This card contains NWAF values RHO. |
| 1-7<br>8-14<br>etc | XAFK | | Cards containing KWAFOR values of wing panel leading edge locations, expressed in percent chord. This card may be identified in columns 73-80 as XAFKJ, where J denotes the |

| Columns | Variable | Value | Description |
|---|---|---|---|
| | | | last location given on that card. Omit if KWAFOR = 0. |
| 1-7<br>8-4<br>etc | YK | | Card containing KWAF values of Y-coordinate of wing panel inboard and outboard edges. This card may be identified in columns 73-80 by YKJ, where J denotes last Y-coordinate on that card. |

Body (Fuselage)

| Columns | Variable | Value | Description |
|---|---|---|---|
| 1-7<br>8-14<br>etc | PHI | | Cards containing KRADX(j) values of the body meridian angles expressed in degrees, and may be identified in columns 73-80 by PHIKJ, where J denotes the body segment number. Convention used is that PHIK = 0 at the bottom of the body and PHIK = 180 at the top of the body. Omit, unless KRADX(j) is negative. Repeat same cards for each fuselage segment. |
| 1-7<br>8-14<br>etc | XJ | | Array containing KFORX(j) values of X-coordinates of body axial stations. This card may be identified in columns 73-80 by XFUSKJ, where J denotes the body segment number. Omit if KFORX(j) = 0. Repeat this card for each fuselage segment. |

Fin

| Columns | Variable | Value | Description |
|---|---|---|---|
| 1-7<br>8-14<br>etc | RHO | | Array containing NF fin leading edge RADII. This array is required only if K4 = 3. This card is identified in columns 73-80 by RHOFIN. |
| 1-7<br>8-14<br>etc | XAFK | | Array containing KFINOR(j) values of fin panel leading edge locations. This card is required only if K4 = 1. It may be identified in columns 73-80 by KFINKJ, where J denotes the fin number. Repeat this card for each fin. |
| 1-7<br>8-14<br>etc | YK | | This array contains KF(j) values of the Z-coordinates of the fin panel inboard edges. This card is identified in columns 73-80 as ZFINKJ, |

| Columns | Variable | Value | Description |
| --- | --- | --- | --- |
| | | | where J denotes the fin number. These values start with the most inboard values. |

Canard

| Columns | Variable | Value | Description |
| --- | --- | --- | --- |
| 1-7<br>8-14<br>etc | RHO | | Cards containing NCAN values of canard leading edge RADII, one value for each canard. This card can be identified in columns 73-80 as RHOCAN. This array is input only if K5 = 3. |
| 1-7<br>8-14<br>etc | XCAN | | Card containing KCANOR(j) values of canard panel leading edge X-coordinates expressed in percent chord. The cards may be identified in columns 73-80 by XCANKJ, where J denotes the canard number. Repeat this card for each canard. |
| 1-7<br>8-14<br>etc | YK | | Card containing KCAN(j) values 8-14 of Y-coordinates of panel etc inboard edges. This card may be identified in columns 73-80 by YCANKJ, where J denotes canard number. Repeat this card for each canard. |

NACELLE/Shell Data Cards

The nacelle is modeled as a "ring wing." As such, nacelle inputs may be used to model additional wing, tail, and canard segments. The wing-body interference shell is also modeled as a "ring wing," but with modified boundary conditions so as to properly account for interference.

All segments input in this section will have constant-pressure panels with fixed camber slopes - nacelle and additional wing, tail and canard panels, and shell panels cannot be designed or optimized. Shell panel camber slopes do not enter into shell panel boundary conditions, but are used for shell force and moment calculations.

Panel thickness slopes may be input for all nacelle, wing, tail, canard, or shell segments, but these are ignored for shell segments.

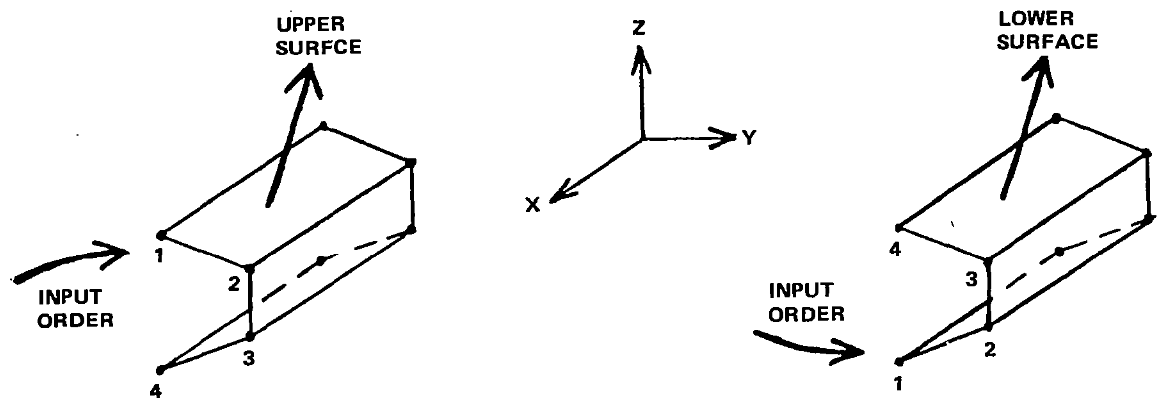
To input nacelles and/or shells, the user should set K6, Card 2.1, equal to some non-zero value. If K6 equals zero, the nacelle/shell data inputs should be omitted. For K6 non-zero, the following cards should be inserted before the first set of "AEROIN" namelist and Mach Number cards:

| Columns | Variable | Value | Description |
|---|---|---|---|
| | | Nacelle/Shell Segment Card | |
| 1-3 | NNAC | $\geq 0$ | Number of nacelle and additional wing, tail, and canard segments to be input. |
| 4-6 | NSHL | $\geq 0$ | Number of shell segments to be input. |

The following set of cards should be input for each nacelle and additional wing, tail, and canard segment, followed by a set for each shell segment:

| Columns | Variable | Value | Description |
|---|---|---|---|
| 1-80 | TITLE | | Any identifying title. |
| 1-3 | NAXI | 2-30 | Number of chordwise stations defining panel leading and trailing edges. NAXI $>0$ implies uncambered nacelle, wing, tail canard or shell panels. NAXI $<0$ implies camber slopes to be input. |
| 4-6 | NRAD | 2-20 | Number of spanwise stations defining panel inboard and outboard edges. NRAD $>$ 0 implies zero thickness nacelle, wing, tail, canard or shell panels. NAXI 0 implies thickness slopes to be input. (Total number of spanwise stations for all nacelle, additional wing, tail and canard, and shell segments may not exceed 20). |
| 1-7<br>8-14<br>etc | XOC | | NAXI values of nacelle, wing, tail, canard, or shell panel leading and trailing edge locations, expressed in present chord. |

| Columns | Variable | Value | Description |
|---|---|---|---|
| 1-6 | X | | X-coordinate of chord leading edge. |
| 8-14 | Y | | Y-coordinate of chord leading edge. |
| 15-21 | Z | | Z-coordinate of chord leading edge. |
| 22-28 | C | | Chord length. |
| | | | This card is repeated NRAD times, with input order determining upper and lower surfaces, e.g.: |




| | | | |
|---|---|---|---|
| 1-7<br>8-14<br>etc | DZCDX | | NRAD-1 sets of cards, one set for each streamwise column of the segment, each containing NAXI values of camber slopes (input only if NAXI$<$0). |
| 1-7<br>8-14<br>etc | DZTDX | | NRAD-1 sets of cards, one set for each streamwise column of the segment, each containing NAXI values of thickness slopes (input only if NRAD$<$0). |

NOTE: Camber and thickness slope values apply at panel leading and trailing edges along chord through panel centroids.

## AEROIN Namelist

The following variables are input using standard Fortran namelist format: the namelist name is "AEROIN."

| Variable | Default | | Remarks |
|---|---|---|---|
| NOPT(1) | 1 | =1 | Analysis or design case. |
| | | =2 | Optimization case. |

If NOPT(1)=1, the following values of NOPT(2) are used:

| | | | |
|---|---|---|---|
| NOPT(2) | 0 | =0 | Cambers used from geometry input. |
| | | =1 | Cambers used from previous cycle. |
| | | =2 | Mixed design-analysis case. |
| | | =3 | Full design case. |
| | | =4 | Conical panel mixed design-analysis case. |

If NOPT(1)=2, the following values of NOPT(2) are used:

| | | | |
|---|---|---|---|
| NOPT(2) | 0 | =-1 | Mixed design-optimization case with $C_L$ constraint only. |
| | | =-2 | Mixed design-optimization case with $C_L$ and $X_{CP}$ constraints. |
| | | =-3 | Conical panel mixed design-optimization case with $C_L$ constraint only. |
| | | =-4 | Conical panel mixed design-optimization case with $C_L$ and $X_{CP}$ constraints. |
| | | =1 | Full optimization, $C_L$ constraint only |
| | | =2 | Full optimization, $C_L$ and $X_{CP}$. constraints. |
| NOPT(3) | 0 | =0 | Iterative technique specified by variable 'ITMETH' is used to determine singularity strengths (analysis case only). |
| | | =1 | Inverse of AIC matrix is used to determine singularity strengths (should be used only if iterative solutions fail to converge or for drag polar calculations). |

| Variable | Default | | Remarks |
|---|---|---|---|
| NOPT(4) | 0 | =0 | Panels with linearly varying vorticity are used. Program automatically assigns C.P. location and trailing edge singularities. |
| | | =2 | Panels with constant vorticity and C.P.'s at 95% panel chord are used. No trailing edge singularities are assigned (C.P.'s at 85% chord for subsonic Mach numbers). |
| NOPT(5) | 0 | =0 | For mixed design-optimization cycles, drag is minimized on portion of wing where pressures are not specified. |
| | | =1 | For mixed design-optimization cycles drag is minimized on total wing surface. |
| NOPT(6) | 0 | =0 | Normal camber input. |
| | | =1 | Camber slopes are input by user at control points of each panel. (These cambers replace any cambers generated during a previous cycle - use only if NOPT(1) = 1). |
| NSTNS | 0 | Number of wing stations at which the spanwise pressure distribution is desired (maximum of 20). | |
| XSTN(1)<br>XSTN(2)<br>XSTN(3) | 0 | X locations at which the spanwise pressure distribution is desired. (NXSTNS values). | |
| XLAMDA | 57.0 | Value of leading edge sweep in degrees. (Required for each case) | |
| XAPEX<br>YAPEX | 0<br>0 | Origin for center of conicity for cases where the origin is not zero. | |

NOTE: XLAMDA is used in the calculation of the spanwise velocity correction "VFIX."

XLAMDA, XAPEX, and YAPEX are used to determine the spanwise location of points output for the wing spanwise pressure distribution. These points are at the specified X locations and lie along the chords through wing panel centroids.

Mach Number and Angle-of-Attack

| Columns | Variable | Remarks |
|---|---|---|
| 1-7 | XMACH | The free stream subsonic or supersonic Mach number for which a solution is desired. |
| 8-14 | ALPHA | The angle of attack in degrees for which a solution is desired. |
| 15-21 | CLBAR | Design lift coefficient (optimization options only). |
| 22-28 | XCP | Center of pressure (x-coordinate) constraint (optimization options only). |

Several of the Options require additional information:

Mixed Design-Analysis (NOPT(1) = 1, NOPT(2) = 2)

| Card No. | Format | Field | Name | Remarks |
|---|---|---|---|---|
| MA1 | I5 | 1 | NFIX | Number of panels for which prescribed pressures will be input. |
| MA2* | 10I5 | 1-10 | IFIX(i), i=1,NFIX | Panel ID numbers in ascending order for which prescribed pressures are input. |
| MA3* | 7F10.2 | 1-7 | PRESS(i), i=1,NFIX | Prescribed lifting pressure coefficients corresponding to panel ID's on MA2. |
| MA4* | 7F10.2 | 1-7 | SLOPES(i), i=1,NUM | Wing camber slopes at panel control points for all panels where pressures have not been specified. (NUM = total number wing panels - NFIX). |

Full Design (NOPT(1) = 1, NOPT(2) = 3)

| Card No. | Format | Field | Name | Remarks |
|---|---|---|---|---|
| F11* | 7F10.2 | 1-7 | PRESS(i), i=1,NWING | Prescribed lifting pressure coefficients for all wing panels. |

Camber Slope Input (Full Analysis Only) (NOPT(6) = 1)

| Card No. | Format | Field | Name | Remarks |
|---|---|---|---|---|
| CS1* | 7F10.2 | 1-7 | SLOPES(i), i=1,NWING | Wing camber slopes at panel control points for all panels. |

---

* Repeat card until all values are entered.

| Card No. | Format | Field | Name | Remarks |
|---|---|---|---|---|

Mixed Design-Optimization (NOPT(1) = 2, NOPT(2) = -1, -2)

General Design

| | | | | |
|---|---|---|---|---|
| MD1 | I5 | 1 | NFIX | Number of panels for which prescribed pressures will be input. |
| MD2* | 10I5 | 1-10 | IFIX(i), i=1,NFIX | Panel ID numbers in ascending order for which prescribed pressures are input. |
| MD3* | 7F10.2 | 1-7 | PRESS(i), i=1,NFIX | Prescribed lifting pressure coefficients corresponding to panel ID's given on MD2. |

Conical Panel Mixed Design-Analysis (NOPT(1), NOPT(2)=4)

and

Conical Panel Mixed Design-Optimization (NOPT(1) = 2, NOPT(2) = -3, -4)

Both of these options require the following additional inputs, which include specification of a conical planform via XLAMLE, XORIGC, and YORIGC, a ray dividing this planform into a supercritical panel (outboard of dividing ray) and subcritical panel (inboard of dividing ray) via ETADR, and a conical lifting-pressure distribution, $\Delta C_p$ versus $\eta$, via ETAC and DCPC.

For W12SC3 alone runs, the user must supply the following inputs. For combined COREL/W12SC3 runs with KCCC = 0 (see COREL inputs) these parameters are automatically appended to the data set during COREL execution, and should not be input by the user.

| | | | | |
|---|---|---|---|---|
| C1 | Literal | | TITLE | 80 characters describing conical pressure distribution |
| C2 | 5F10.0 | 1 | FCCC | Number of $\eta$, $\Delta Cp$ pairs defining the conical panel pressures |
| | | 2 | XLAMLE | The leading edge sweep angle for these pressures |

---

* Repeat card until all values are entered.

| Card No. | Format | Field | Name | Remarks |
|---|---|---|---|---|
| | | 3 | ETADR | The dividing ray (pressures are specified outboard of this ray) |
| | | 4 | XORIGC | X origin of conical panel for this calculation |
| | | 5 | YORIGC | Y origin of conical panel for this calculation |
| C3 | 2F10.0 | 1 | ETAC | $\eta$ location of $\Delta C_p$ |
| | | 2 | DCPC | $\Delta C_p$ at this $\eta$ value |

NOTE: Card C3 is repeated FCCC times. The values are input starting with $\eta = 0$ (the centerline) and proceeding to $\eta = 1$ (the leading edge).

To Start A New Case - Simply repeat the AEROIN namelist, Mach Number and Angle of Attack Card, and any required additional information.

To Signal End of Execution - Execution stops when the end of the data set is encountered.

Paneling Rules - The following rules should be followed when modeling configurations:

- A total of 1653 panels may be used to model all surfaces
  - 551 wing, fin, and canard panels
  - 551 shell and additional nacelle, wing, and canard panels
  - 551 body panels
- A total of 19 streamwise strips is allowed for all wing, fin, and canard panels
- The maximum number of panels in the streamwise direction is 29 on each wing, fin, or canard surface
- A total of 29 panels in the streamwise direction is allowed for all body segments
- The maximum number of panels used to model the body cross-section is 19 on each body segment

- A total of 19 streamwise strips is allowed for all interference shell and additional nacelle, wing, and canard surfaces
- The maximum number of panels in the streamwise direction is 29 on each interference shell and each additional nacelle, wing, and canard surface
- If utilizing iterative solution techniques, the number of panels on circumferential fuselage strips should be an integer factor of 60. This is not a rigid rule, however, and can be relaxed if matrix inversion is used as a solution method, or if the iteration techniques converge in a reasonable number of cycles
- For design-optimization problems, a uniform wing paneling distribution should produce smoother results in most cases (see ref. 5)
- For calculation of leading edge thrust from the computed pressure distribution, a nonuniform streamwise spacing is necessary, with leading edge boxes of the order $10^{-2}$ to $10^{-3}$ chord lengths. Spanwise cosine spacing will also improve results. A limited number of analyses indicate that constant strength vortex panels (Woodward I panels) produce the most accurate results.

## W12SC3: Output Data

The W12SC3 program output consists of two parts:

- A complete listing of the input data cards
- Program execution output.

The quantity and type of execution output depends upon the PRINT option selected, the number of panels used, and/or the number of components of the configuration.

The program execution output options are described below:

PRINT = 0 The program prints the case description, Mach number and angle-of-attack, followed by a table listing the panel number, control point coordinates (both dimensional and nondimensional), pressure coefficient, normal force, axial force, and pitching moment. Separate tables are printed for the body, wing, and shell panels. If the planar boundary condition option has been selected, the results

for the wing or shell upper surface are given in one table, followed by a separate table giving results for the wing or shell lower surface. Additional tables giving the total coefficients on the body, the wing, the shell, and the complete configuration follow the pressure coefficient tables. These include the reference area, reference span and reference chord, normal force, axial force, pitching moment, lift and drag coefficients, and center of pressure of the component.

PRINT = 1 In addition to the output described for PRINT = 0, the program prints out additional tables giving the normal force, axial force, pitching moment, lift and drag coefficients, and the center of pressure of each column of panels on the wing and tail surfaces.

PRINT = 2 In addition to the output described for PRINT = 1, the program prints out tables listing the panel number, the source or the vortex strength of that panel, and the axial velocity u, lateral velocity v, and vertical velocity w at the panel control point. The normal velocity is also calculated for body panels. Separate tables are printed for the body, wing, and shell panels. If the planar boundary condition option has been selected, separate tables are given for the wing and shell upper and lower surfaces.

PRINT = 3 In addition to the output described for PRINT = 2, the program program prints out the iteration number, and the source and vortex strength arrays obtained at each step of the iterative solution procedure.

PRINT = 4 In addition to the output described for PRINT = 3, the program program prints out tables of the axial and normal velocity components which make up the elements of the aerodynamic matrices. The program prints out the matrix row number, and gives the number of elements in that row. A maximum of nine matrix partitions will be printed if this option is selected, each of which is identified by a number and its influence description prior to printing the velocity component tables.

If a negative value of PRINT is selected, the program prints all the information described above for the positive values, together with the complete panel geometry description of the configuration following the list of input cards. This consists of tables giving the wing, body, fin, tail, and shell panel corner points, control points, inclination angles, areas, and chords.

## SAMPLE CASE

The following case illustrates the use of the programs and provides a check case for verification. The wing alone mixed design-optimization calculation provides an example of most of the features of the two codes. This case was run on both the Grumman CDC CYBER 740 and NASA LaRC CYBER 175, with identical results.

### Input Data

The following data set is used for the sample case:

```
DEMONSTRATION WING FOR SC3 WING CONCEPT
 M=1.62, ALPHA=12.0 , AZ=33.00  XSTN=19.90
$INPUT IC=30,JC=30,KMAX(1)=350,KMAX(2)=250,KREF=2,IPLOT=1,
 EMINF=1.62,ALP=12.0,AZ=33.0,BZ=1.5,IOUT=1,IOUT2=0,IRPTS=1,IPUNCH=3,
 XSTN=19.9,ETADR=0.75,IEQV=1,XORIGC=3.907,IEQV3=0,NS=4 $END
 SPANWISE SECTION AT XSTN=19.9 FOR COREL ANALYSIS
0.0       1.0        61.0       61.0
 UPPER SURFACE
 1.000000 -0.021157      0.669131  0.058800
 0.999657 -0.019435      0.649448  0.062061
 0.998630 -0.017660      0.629320  0.065222
 0.996917 -0.015830      0.608761  0.068248
 0.994522 -0.013943      0.587785  0.071099
 0.991445 -0.011998      0.566406  0.073732
 0.987688 -0.009992      0.544639  0.076104
 0.983255 -0.007927      0.522499  0.078171
 0.978148 -0.005801      0.500000  0.079890
 0.972370 -0.003618      0.477159  0.081221
 0.965926 -0.001380      0.453990  0.082126
 0.958820  0.000908      0.430511  0.082573
 0.951057  0.003238      0.406737  0.082533
 0.942641  0.005602      0.382683  0.081941
 0.933580  0.007988      0.358368  0.080660
 0.923880  0.010382      0.333807  0.078690
 0.913545  0.012768      0.309017  0.076057
 0.902585  0.015130      0.284015  0.072813
 0.891007  0.017486      0.258819  0.069029
 0.878817  0.019914      0.233445  0.064794
 0.866025  0.022426      0.207912  0.060212
 0.852640  0.025024      0.182236  0.055393
 0.838671  0.027712      0.156434  0.050449
 0.824126  0.030490      0.130526  0.045482
 0.809017  0.033360      0.104528  0.040574
 0.793353  0.036317      0.078459  0.035776
 0.777146  0.039358      0.052336  0.031096
 0.760406  0.042475      0.026177  0.026479
 0.743145  0.045656      0.0       0.021799
 0.725374  0.048895
 0.707107  0.052177
 0.688355  0.055486
```

```
LOWER SURFACE
1.000000 -0.021157          0.688355   0.015338
0.999657 -0.022682          0.669131   0.018012
0.998630 -0.023870          0.649448   0.020667
0.996917 -0.024727          0.629320   0.023256
0.994522 -0.025266          0.608761   0.025744
0.991445 -0.025500          0.587785   0.028093
0.987688 -0.025448          0.566406   0.030261
0.983255 -0.025130          0.544639   0.032207
0.978148 -0.024568          0.522499   0.033888
0.972370 -0.023790          0.500000   0.035264
0.965926 -0.022821          0.477159   0.036295
0.958820 -0.021690          0.453990   0.036943
0.951057 -0.020426          0.430511   0.037177
0.942641 -0.019060          0.406737   0.036968
0.933580 -0.017623          0.382683   0.036250
0.923880 -0.016144          0.358368   0.034884
0.913545 -0.014655          0.333807   0.032869
0.902585 -0.013181          0.309017   0.030229
0.891007 -0.011714          0.284015   0.027015
0.878817 -0.010180          0.258819   0.023295
0.866025 -0.008570          0.233445   0.019157
0.852640 -0.006881          0.207912   0.014702
0.838671 -0.005106          0.182236   0.010039
0.824126 -0.003240          0.156434   0.005278
0.809017 -0.001275          0.130526   0.000519
0.793353  0.000793          0.104528  -0.004157
0.777146  0.002968          0.078459  -0.008700
0.760406  0.005254          0.052336  -0.013106
0.743145  0.007645          0.026177  -0.017430
0.725374  0.010134          0.0       -0.021799
0.707107  0.012704
SC3 DEMO   WING ALONE FOR COMBINED ANALYSIS DESIGN-CRAIDON GEOMETRY
 0  1   0   0   0   0   0  20 30
 0.0     0.147   0.586   1.317   2.338   3.645   5.235   7.102   9.242  11.649
14.314  17.231  20.391  23.784  27.400  31.230  35.261  39.483  43.881  48.445
53.159  58.011  62.986  68.070  73.247  78.503  83.822  89.188  94.586100.000
-0.0000 0.0     0.0    23.8401
 1.6587 0.7735-0.165622.3368
 3.3171 1.5471-0.272320.8338
 4.9747 2.3206-0.334119.3317
 6.6296 3.0941-0.361617.8324
 8.2770 3.8676-0.363716.3413
 9.9051 4.6412-0.348414.8714
11.4905 5.4147-0.323313.4495
13.0004 6.1882-0.295512.1174
14.4103 6.9617-0.278110.9170
15.7249 7.7353-0.2864 9.8687
16.9739 8.5088-0.2616 8.9614
18.1883 9.2823-0.2386 8.1602
19.387910.0558-0.2230 7.4225
20.581910.8294-0.2179 6.7156
21.773911.6029-0.2164 6.0212
22.965312.3764-0.2192 5.3313
24.156613.1499-0.2286 4.6430
25.357313.9235-0.2459 3.9456
27.500014.6970-0.1566 2.3063
 0.0    0.0000 0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0
 0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0
 0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0000
 0.0    0.0085 0.0310 0.0615 0.0962 0.1328 0.1684 0.2006 0.2279 0.2500
 0.2665 0.2780 0.2857 0.2908 0.2942 0.2963 0.2977 0.2986 0.2991 0.2994
 0.2995 0.2995 0.2995 0.2993 0.2992 0.2990 0.2989 0.2987 0.2986 0.2986
 0.0    0.0073 0.0281 0.0593 0.0972 0.1396 0.1851 0.2323 0.2793 0.3245
 0.3662 0.4037 0.4365 0.4647 0.4880 0.5061 0.5200 0.5302 0.5377 0.5428
 0.5461 0.5480 0.5488 0.5488 0.5482 0.5473 0.5462 0.5451 0.5442 0.5433
 0.0    0.0063 0.0247 0.0533 0.0898 0.1317 0.1777 0.2269 0.2784 0.3310
 0.3834 0.4344 0.4827 0.5276 0.5685 0.6054 0.6381 0.6669 0.6909 0.7101
 0.7250 0.7360 0.7436 0.7484 0.7511 0.7521 0.7521 0.7517 0.7509 0.7500
 0.0    0.0055 0.0214 0.0469 0.0802 0.1196 0.1634 0.2109 0.2613 0.3140
 0.3684 0.4235 0.4784 0.5321 0.5838 0.6329 0.6788 0.7214 0.7603 0.7953
 0.8262 0.8516 0.8715 0.8865 0.8974 0.9050 0.9104 0.9142 0.9167 0.9181
 0.0    0.0047 0.0185 0.0409 0.0706 0.1064 0.1470 0.1913 0.2388 0.2889
 0.3415 0.3959 0.4516 0.5081 0.5645 0.6202 0.6744 0.7265 0.7757 0.8212
 0.8625 0.8993 0.9315 0.9589 0.9810 0.9989 1.0135 1.0251 1.0344 1.0416
```

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.0041 | 0.0160 | 0.0355 | 0.0618 | 0.0939 | 0.1308 | 0.1715 | 0.2155 | 0.2622 |
| 0.3115 | 0.3633 | 0.4172 | 0.4729 | 0.5300 | 0.5877 | 0.6453 | 0.7019 | 0.7564 | 0.8080 |
| 0.8559 | 0.8996 | 0.9390 | 0.9740 | 1.0053 | 1.0337 | 1.0590 | 1.0807 | 1.0992 | 1.1149 |
| 0.0 | 0.0035 | 0.0140 | 0.0310 | 0.0542 | 0.0829 | 0.1162 | 0.1535 | 0.1940 | 0.2373 |
| 0.2832 | 0.3317 | 0.3826 | 0.4357 | 0.4907 | 0.5470 | 0.6038 | 0.6603 | 0.7156 | 0.7689 |
| 0.8193 | 0.8665 | 0.9101 | 0.9505 | 0.9881 | 1.0230 | 1.0552 | 1.0848 | 1.1119 | 1.1367 |
| 0.0 | 0.0031 | 0.0123 | 0.0275 | 0.0482 | 0.0739 | 0.1041 | 0.1382 | 0.1755 | 0.2155 |
| 0.2580 | 0.3029 | 0.3500 | 0.3992 | 0.4502 | 0.5026 | 0.5557 | 0.6090 | 0.6618 | 0.7134 |
| 0.7633 | 0.8109 | 0.8565 | 0.9003 | 0.9421 | 0.9816 | 1.0189 | 1.0539 | 1.0866 | 1.1170 |
| 0.0 | 0.0026 | 0.0105 | 0.0235 | 0.0413 | 0.0636 | 0.0902 | 0.1235 | 0.1613 | 0.2015 |
| 0.2423 | 0.2832 | 0.3260 | 0.3704 | 0.4163 | 0.4635 | 0.5116 | 0.5601 | 0.6086 | 0.6566 |
| 0.7037 | 0.7505 | 0.7966 | 0.8417 | 0.8855 | 0.9277 | 0.9683 | 1.0070 | 1.0438 | 1.0786 |
| 0.0 | 0.0031 | 0.0123 | 0.0276 | 0.0487 | 0.0750 | 0.1057 | 0.1396 | 0.1758 | 0.2132 |
| 0.2507 | 0.2876 | 0.3257 | 0.3650 | 0.4056 | 0.4472 | 0.4897 | 0.5327 | 0.5760 | 0.6199 |
| 0.6644 | 0.7093 | 0.7541 | 0.7987 | 0.8425 | 0.8855 | 0.9274 | 0.9679 | 1.0069 | 1.0444 |
| 0.0 | 0.0029 | 0.0114 | 0.0253 | 0.0443 | 0.0677 | 0.0950 | 0.1253 | 0.1578 | 0.1916 |
| 0.2257 | 0.2593 | 0.2926 | 0.3270 | 0.3622 | 0.3983 | 0.4351 | 0.4731 | 0.5125 | 0.5529 |
| 0.5942 | 0.6361 | 0.6785 | 0.7209 | 0.7632 | 0.8051 | 0.8463 | 0.8868 | 0.9262 | 0.9644 |
| 0.0 | 0.0025 | 0.0099 | 0.0220 | 0.0386 | 0.0590 | 0.0830 | 0.1096 | 0.1384 | 0.1685 |
| 0.1992 | 0.2295 | 0.2590 | 0.2885 | 0.3193 | 0.3514 | 0.3847 | 0.4192 | 0.4549 | 0.4917 |
| 0.5294 | 0.5678 | 0.6068 | 0.6462 | 0.6857 | 0.7253 | 0.7645 | 0.8034 | 0.8416 | 0.8790 |
| 0.0 | 0.0021 | 0.0085 | 0.0188 | 0.0330 | 0.0506 | 0.0712 | 0.0942 | 0.1193 | 0.1458 |
| 0.1734 | 0.2015 | 0.2294 | 0.2568 | 0.2848 | 0.3139 | 0.3441 | 0.3753 | 0.4074 | 0.4405 |
| 0.4744 | 0.5090 | 0.5443 | 0.5800 | 0.6161 | 0.6523 | 0.6886 | 0.7247 | 0.7605 | 0.7958 |
| 0.0 | 0.0018 | 0.0073 | 0.0163 | 0.0287 | 0.0442 | 0.0624 | 0.0832 | 0.1060 | 0.1304 |
| 0.1561 | 0.1824 | 0.2089 | 0.2351 | 0.2608 | 0.2871 | 0.3142 | 0.3420 | 0.3707 | 0.4001 |
| 0.4302 | 0.4610 | 0.4923 | 0.5241 | 0.5563 | 0.5887 | 0.6213 | 0.6538 | 0.6863 | 0.7185 |
| 0.0 | 0.0016 | 0.0064 | 0.0144 | 0.0253 | 0.0390 | 0.0552 | 0.0738 | 0.0942 | 0.1163 |
| 0.1396 | 0.1638 | 0.1885 | 0.2132 | 0.2375 | 0.2613 | 0.2854 | 0.3101 | 0.3354 | 0.3612 |
| 0.3876 | 0.4145 | 0.4419 | 0.4696 | 0.4977 | 0.5260 | 0.5545 | 0.5831 | 0.6117 | 0.6401 |
| 0.0 | 0.0014 | 0.0056 | 0.0124 | 0.0219 | 0.0338 | 0.0480 | 0.0642 | 0.0822 | 0.1018 |
| 0.1226 | 0.1444 | 0.1667 | 0.1894 | 0.2120 | 0.2344 | 0.2561 | 0.2777 | 0.2997 | 0.3221 |
| 0.3449 | 0.3681 | 0.3916 | 0.4154 | 0.4394 | 0.4636 | 0.4879 | 0.5124 | 0.5368 | 0.5612 |
| 0.0 | 0.0012 | 0.0047 | 0.0105 | 0.0185 | 0.0287 | 0.0408 | 0.0547 | 0.0702 | 0.0871 |
| 0.1052 | 0.1243 | 0.1441 | 0.1643 | 0.1847 | 0.2051 | 0.2252 | 0.2449 | 0.2639 | 0.2831 |
| 0.3025 | 0.3221 | 0.3420 | 0.3620 | 0.3821 | 0.4024 | 0.4227 | 0.4431 | 0.4634 | 0.4837 |
| 0.0 | 0.0010 | 0.0038 | 0.0085 | 0.0151 | 0.0233 | 0.0332 | 0.0446 | 0.0574 | 0.0714 |
| 0.0864 | 0.1024 | 0.1192 | 0.1365 | 0.1543 | 0.1723 | 0.1905 | 0.2085 | 0.2262 | 0.2434 |
| 0.2597 | 0.2760 | 0.2924 | 0.3088 | 0.3253 | 0.3419 | 0.3584 | 0.3749 | 0.3914 | 0.4078 |
| 0.0 | 0.0004 | 0.0016 | 0.0036 | 0.0064 | 0.0100 | 0.0144 | 0.0195 | 0.0253 | 0.0318 |
| 0.0389 | 0.0467 | 0.0551 | 0.0640 | 0.0734 | 0.0833 | 0.0936 | 0.1043 | 0.1154 | 0.1267 |
| 0.1355 | 0.1444 | 0.1533 | 0.1624 | 0.1715 | 0.1806 | 0.1898 | 0.1990 | 0.2082 | 0.2173 |
| 0.0 | 0.1866 | 0.3670 | 0.5412 | 0.7088 | 0.8696 | 1.0230 | 1.1685 | 1.3057 | 1.4337 |
| 1.5517 | 1.6588 | 1.7539 | 1.8357 | 1.9029 | 1.9538 | 1.9867 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.2168 | 0.4199 | 0.6094 | 0.7856 | 0.9490 | 1.1001 | 1.2393 | 1.3674 | 1.4845 |
| 1.5912 | 1.6873 | 1.7727 | 1.8466 | 1.9081 | 1.9555 | 1.9870 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.2432 | 0.4660 | 0.6689 | 0.8527 | 1.0184 | 1.1674 | 1.3012 | 1.4212 | 1.5290 |
| 1.6257 | 1.7122 | 1.7891 | 1.8561 | 1.9126 | 1.9571 | 1.9872 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.2657 | 0.5054 | 0.7197 | 0.9099 | 1.0776 | 1.2249 | 1.3540 | 1.4672 | 1.5669 |
| 1.6551 | 1.7335 | 1.8031 | 1.8642 | 1.9165 | 1.9584 | 1.9874 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.2844 | 0.5381 | 0.7619 | 0.9574 | 1.1268 | 1.2726 | 1.3978 | 1.5054 | 1.5984 |
| 1.6795 | 1.7511 | 1.8147 | 1.8710 | 1.9198 | 1.9596 | 1.9876 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.2993 | 0.5640 | 0.7954 | 0.9951 | 1.1658 | 1.3104 | 1.4325 | 1.5357 | 1.6234 |
| 1.6989 | 1.7651 | 1.8239 | 1.8763 | 1.9223 | 1.9604 | 1.9878 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.3103 | 0.5833 | 0.8202 | 1.0231 | 1.1947 | 1.3385 | 1.4583 | 1.5581 | 1.6419 |
| 1.7133 | 1.7755 | 1.8307 | 1.8803 | 1.9242 | 1.9611 | 1.9879 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.3174 | 0.5958 | 0.8363 | 1.0412 | 1.2135 | 1.3568 | 1.4751 | 1.5727 | 1.6539 |
| 1.7226 | 1.7822 | 1.8351 | 1.8829 | 1.9255 | 1.9615 | 1.9879 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.3207 | 0.6016 | 0.8438 | 1.0496 | 1.2222 | 1.3652 | 1.4828 | 1.5795 | 1.6595 |
| 1.7269 | 1.7853 | 1.8372 | 1.8841 | 1.9260 | 1.9617 | 1.9880 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.3210 | 0.6020 | 0.8443 | 1.0503 | 1.2229 | 1.3658 | 1.4834 | 1.5800 | 1.6599 |

```
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
AERO SECTION - DEMO WING - BASIC L.E.
  1  1 -2
  1  3  0  0  0  0  0 11 11
171.05 14.697 14.747 0.0    0.0    16.701 0.0
0.1224 0.1705 0.2189 0.2650 0.3066 0.3418 0.3691 0.3874 0.3960 0.3967
0.3967 0.3967 0.3967 0.3967 0.3967 0.3967 0.3967 0.3967 0.3967 0.0000
  0.00  10.00  20.00  30.00  40.00  50.00  60.00  70.00  80.00  90.00
100.00
0.0   1.4697  2.9394 4.4091 5.8788 7.3485 8.818210.287911.757613.2273
14.697
$AERDIN XLAMDA=57.0,NOPT(1)=2,NOPT(2)=-3,NOPT(4)=2,NOPT(5)=1,
NXSTNS=3,XSTN(1)=15.5,XSTN(2)=19.9,XSTN(3)=24.4,XAPEX=3.907,
$END
1.62   12.0   0.4
```

SYSTEM DEPENDENT JOB IDENTIFICATION

JOBN

(FUNCTION LGYRTM)

```
COREL 2   (VERSION OF SEPT.29,1978)                                    GRUMMAN AEROSPACE CORPORATION BETHPAGE N.Y.
CONICAL RELAXATION SOLUTION

BY B. GROSSMAN, PRESENTLY PROFESSOR OF AERONAUTICS - VIRGINIA POLYTECHNIC INSTITUTE,BLACKSBURG,VA.  (703) 961-6740
AERODYNAMIC APPLICATIONS ADAPTATION BY W. MASON      GRUMMAN AEROSPACE CORPORATION ,BETHPAGE, N.Y.  (516) 575-6092


MINF=1.620     ALP=12.000

IC= 30         JC= 30         KMAX1= 350     KMAX2= 250     KMAX3= 150     KREF=2              IPLOT= 1
GAMMA=1.40     WW1=1.000      WW2=1.500      WW3=1.500      EST=-6.00      DMIN1=  .10E-05     DMIN2=  .10E-05     DMIN3=  .10E-05

  DEMONSTRATION WING FOR SC3 WING CONCEPT
   M=1.62, ALPHA=12.0 , AZ=33.00  XSTN=19.90

AZ=33.000      BZ= 1.500      NG=199         NS= 4          LC= 0          LT= 1          LM= 0
CC(1)=  0.000  CC(2)= 0.000   CC(3)= 0.000   CT(1)= 0.000   CT(2)= 0.000   CT(3)= 0.000   CM(1)= 0.000   CM(2)= 0.000
IOUT=  1       IDESIN= 0      KDESMX= 0      IRPTS= 1       IOUT2=0        IPUNCH=3       NSHKR=10       KSHKR= 8
JDRLX= 6       WDES=0.000     ETADR= .750    EPSHKI=1.200   TESWP= 0.00    KCCC= 0        XORIGC= 3.9070 YORIGC= 0.0000
IMOD= 0        IEQV= 1        XU1= 0.000     XU2= 0.000     XU3= 0.000     DCTU= 0.000    XL1= 0.000     XL2= 0.000
XL3= 0.000     DTCL= 0.000    XSTN=  19.900  IEQV3=  0      XROOT=********* ZROOT=  0.00000 YWNGRT= -1.00000

                    SPANWISE SECTION AT XSTN=19.9 FOR COREL ANALYSIS

ZSYM=0.0     THICK=  1.000000     FNU= 61.0     FNL= 61.0     XKSMTH=  0.0     XSING=  0.000000     YSING=  0.000000
```

UPPER SURFACE

| I | X | Y |
|---|---|---|
| 1 | 1.000000 | -.021157 |
| 2 | .999657 | -.019435 |
| 3 | .998630 | -.017660 |
| 4 | .996917 | -.015830 |
| 5 | .994522 | -.013943 |
| 6 | .991445 | -.011998 |
| 7 | .987688 | -.009992 |
| 8 | .983255 | -.007927 |
| 9 | .978148 | -.005801 |
| 10 | .972370 | -.003618 |
| 11 | .965926 | -.001380 |
| 12 | .958820 | .000908 |
| 13 | .951057 | .003238 |
| 14 | .942641 | .005602 |
| 15 | .933580 | .007988 |
| 16 | .923880 | .010382 |
| 17 | .913545 | .012768 |
| 18 | .902585 | .015130 |
| 19 | .891007 | .017486 |
| 20 | .878817 | .019914 |

| | | |
|---|---|---|
| 21 | .866025 | .022426 |
| 22 | .852640 | .025024 |
| 23 | .838671 | .027712 |
| 24 | .824126 | .030490 |
| 25 | .809017 | .033360 |
| 26 | .793353 | .036317 |
| 27 | .777146 | .039358 |
| 28 | .760406 | .042475 |
| 29 | .743145 | .045656 |
| 30 | .725374 | .048895 |
| 31 | .707107 | .052177 |
| 32 | .688355 | .055486 |
| 33 | .669131 | .058800 |
| 34 | .649448 | .062061 |
| 35 | .629320 | .065222 |
| 36 | .608761 | .068248 |
| 37 | .587785 | .071099 |
| 38 | .566406 | .073732 |
| 39 | .544639 | .076104 |
| 40 | .522499 | .078171 |
| 41 | .500000 | .079890 |
| 42 | .477159 | .081221 |
| 43 | .453990 | .082126 |
| 44 | .430511 | .082573 |
| 45 | .406737 | .082533 |
| 46 | .382683 | .081941 |
| 47 | .358368 | .080660 |
| 48 | .333807 | .078690 |
| 49 | .309017 | .076057 |
| 50 | .284015 | .072813 |
| 51 | .258819 | .069029 |
| 52 | .233445 | .064794 |
| 53 | .207912 | .060212 |
| 54 | .182236 | .055393 |
| 55 | .156434 | .050449 |
| 56 | .130526 | .045482 |
| 57 | .104528 | .040574 |
| 58 | .078459 | .035776 |
| 59 | .052336 | .031096 |
| 60 | .026177 | .026479 |
| 61 | 0.000000 | .021799 |

LOWER SURFACE

| I | X | Y |
|---|---|---|
| 1 | 1.000000 | -.021157 |
| 2 | .999657 | -.022682 |
| 3 | .998630 | -.023870 |
| 4 | .996917 | -.024727 |
| 5 | .994522 | -.025266 |
| 6 | .991445 | -.025500 |
| 7 | .987688 | -.025448 |
| 8 | .983255 | -.025130 |
| 9 | .978148 | -.024568 |
| 10 | .972370 | -.023790 |
| 11 | .965926 | -.022821 |
| 12 | .958820 | -.021690 |
| 13 | .951057 | -.020426 |
| 14 | .942641 | -.019060 |

| | | |
|---|---|---|
| 15 | .933580 | -.017623 |
| 16 | .923880 | -.016144 |
| 17 | .913545 | -.014655 |
| 18 | .902585 | -.013181 |
| 19 | .891007 | -.011714 |
| 20 | .878817 | -.010180 |
| 21 | .866025 | -.008570 |
| 22 | .852640 | -.006881 |
| 23 | .838671 | -.005106 |
| 24 | .824126 | -.003240 |
| 25 | .809017 | -.001275 |
| 26 | .793353 | .000793 |
| 27 | .777146 | .002968 |
| 28 | .760406 | .005254 |
| 29 | .743145 | .007645 |
| 30 | .725374 | .010134 |
| 31 | .707107 | .012704 |
| 32 | .688355 | .015338 |
| 33 | .669131 | .018012 |
| 34 | .649448 | .020667 |
| 35 | .629320 | .023256 |
| 36 | .608761 | .025744 |
| 37 | .587785 | .028093 |
| 38 | .566406 | .030261 |
| 39 | .544639 | .032207 |
| 40 | .522499 | .033888 |
| 41 | .500000 | .035264 |
| 42 | .477159 | .036295 |
| 43 | .453990 | .036943 |
| 44 | .430511 | .037177 |
| 45 | .406737 | .036968 |
| 46 | .382683 | .036250 |
| 47 | .358368 | .034884 |
| 48 | .333807 | .032869 |
| 49 | .309017 | .030229 |
| 50 | .284015 | .027015 |
| 51 | .258819 | .023295 |
| 52 | .233445 | .019157 |
| 53 | .207912 | .014702 |
| 54 | .182236 | .010039 |
| 55 | .156434 | .005278 |
| 56 | .130526 | .000519 |
| 57 | .104528 | -.004157 |
| 58 | .078459 | -.008700 |
| 59 | .052336 | -.013106 |
| 60 | .026177 | -.017430 |
| 61 | 0.000000 | -.021799 |

PROGRAM 03400 (SPADE) - SURFACE PATCH DEFINITION EQUATIONS

→ FROM THE CRAIDON PROGRAM – SUBROUTINE START IN COREL

AIRCRAFT CONFIGURATION DESCRIPTION

```
SC3 DEMO  WING ALONE FOR COMBINED ANALYSIS DESIGN-CRAIDON GEOMETRY

0  1  0  0  0  0  0 20 30  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0

 0.000   .147   .586  1.317  2.338  3.645  5.235  7.102  9.242 11.649
14.314 17.231 20.391 23.784 27.400 31.230 35.261 39.483 43.881 48.445
53.159 58.011 62.986 68.070 73.247 78.503 83.822 89.188 94.586100.000
 0.000  0.000  0.000 23.840
 1.659   .774  -.166 22.337
 3.317  1.547  -.272 20.834
 4.975  2.321  -.334 19.332
 6.630  3.094  -.362 17.832
 8.277  3.868  -.364 16.341
 9.905  4.641  -.348 14.871
11.491  5.415  -.323 13.450
13.000  6.188  -.296 12.117
14.410  6.962  -.278 10.917
15.725  7.735  -.286  9.869
16.974  8.509  -.262  8.961
18.188  9.282  -.239  8.160
19.388 10.056  -.223  7.423
20.582 10.829  -.218  6.716
21.774 11.603  -.216  6.021
22.965 12.376  -.219  5.331
24.157 13.150  -.229  4.643
25.357 13.924  -.246  3.946
27.500 14.697  -.157  2.306
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000  .0085  .0310  .0615  .0962  .1328  .1684  .2006  .2279  .2500
 .2665  .2780  .2857  .2908  .2942  .2963  .2977  .2986  .2991  .2994
 .2995  .2995  .2995  .2993  .2992  .2990  .2989  .2987  .2986  .2986
0.0000  .0073  .0281  .0593  .0972  .1396  .1851  .2323  .2793  .3245
 .3662  .4037  .4365  .4647  .4880  .5061  .5200  .5302  .5377  .5428
 .5461  .5480  .5488  .5488  .5482  .5473  .5462  .5451  .5442  .5433
0.0000  .0063  .0247  .0533  .0898  .1317  .1777  .2269  .2784  .3310
 .3834  .4344  .4827  .5276  .5685  .6054  .6381  .6669  .6909  .7101
 .7250  .7360  .7436  .7484  .7511  .7521  .7521  .7517  .7509  .7500
0.0000  .0055  .0214  .0469  .0802  .1196  .1634  .2109  .2613  .3140
 .3684  .4235  .4784  .5321  .5838  .6329  .6788  .7214  .7603  .7953
 .8262  .8516  .8715  .8865  .8974  .9050  .9104  .9142  .9167  .9181
0.0000  .0047  .0185  .0409  .0706  .1064  .1470  .1913  .2388  .2889
 .3415  .3959  .4516  .5081  .5645  .6202  .6744  .7265  .7757  .8212
 .8625  .8993  .9315  .9589  .9810  .9989 1.0135 1.0251 1.0344 1.0416
0.0000  .0041  .0160  .0355  .0618  .0939  .1308  .1715  .2155  .2622
 .3115  .3633  .4172  .4729  .5300  .5877  .6453  .7019  .7564  .8080
 .8559  .8996  .9390  .9740 1.0053 1.0337 1.0590 1.0807 1.0992 1.1149
0.0000  .0035  .0140  .0310  .0542  .0829  .1162  .1535  .1940  .2373
 .2832  .3317  .3826  .4357  .4907  .5470  .6038  .6603  .7156  .7689
 .8193  .8665  .9101  .9505  .9881 1.0230 1.0552 1.0848 1.1119 1.1367
0.0000  .0031  .0123  .0275  .0482  .0739  .1041  .1382  .1755  .2155
 .2580  .3029  .3500  .3992  .4502  .5026  .5557  .6090  .6618  .7134
 .7633  .8109  .8565  .9003  .9421  .9816 1.0189 1.0539 1.0866 1.1170
```

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.0000 | .0026 | .0105 | .0235 | .0413 | .0636 | .0902 | .1235 | .1613 | .2015 |
| .2423 | .2832 | .3260 | .3704 | .4163 | .4635 | .5116 | .5601 | .6086 | .6566 |
| .7037 | .7505 | .7966 | .8417 | .8855 | .9277 | .9683 | 1.0070 | 1.0438 | 1.0786 |
| 0.0000 | .0031 | .0123 | .0276 | .0487 | .0750 | .1057 | .1396 | .1758 | .2132 |
| .2507 | .2876 | .3257 | .3650 | .4056 | .4472 | .4897 | .5327 | .5760 | .6199 |
| .6644 | .7093 | .7541 | .7987 | .8425 | .8855 | .9274 | .9679 | 1.0069 | 1.0444 |
| 0.0000 | .0029 | .0114 | .0253 | .0443 | .0677 | .0950 | .1253 | .1578 | .1916 |
| .2257 | .2593 | .2926 | .3270 | .3622 | .3983 | .4351 | .4731 | .5125 | .5529 |
| .5942 | .6361 | .6785 | .7209 | .7632 | .8051 | .8463 | .8868 | .9262 | .9644 |
| 0.0000 | .0025 | .0099 | .0220 | .0386 | .0590 | .0830 | .1096 | .1384 | .1685 |
| .1992 | .2295 | .2590 | .2885 | .3193 | .3514 | .3847 | .4192 | .4549 | .4917 |
| .5294 | .5678 | .6068 | .6462 | .6857 | .7253 | .7645 | .8034 | .8416 | .8790 |
| 0.0000 | .0021 | .0085 | .0188 | .0330 | .0506 | .0712 | .0942 | .1193 | .1458 |
| .1734 | .2015 | .2294 | .2568 | .2848 | .3139 | .3441 | .3753 | .4074 | .4405 |
| .4744 | .5090 | .5443 | .5800 | .6161 | .6523 | .6886 | .7247 | .7605 | .7958 |
| 0.0000 | .0018 | .0073 | .0163 | .0287 | .0442 | .0624 | .0832 | .1060 | .1304 |
| .1561 | .1824 | .2089 | .2351 | .2608 | .2871 | .3142 | .3420 | .3707 | .4001 |
| .4302 | .4610 | .4923 | .5241 | .5563 | .5887 | .6213 | .6538 | .6863 | .7185 |
| 0.0000 | .0016 | .0064 | .0144 | .0253 | .0390 | .0552 | .0738 | .0942 | .1163 |
| .1396 | .1638 | .1885 | .2132 | .2375 | .2613 | .2854 | .3101 | .3354 | .3612 |
| .3876 | .4145 | .4419 | .4696 | .4977 | .5260 | .5545 | .5831 | .6117 | .6401 |
| 0.0000 | .0014 | .0056 | .0124 | .0219 | .0338 | .0480 | .0642 | .0822 | .1018 |
| .1226 | .1444 | .1667 | .1894 | .2120 | .2344 | .2561 | .2777 | .2997 | .3221 |
| .3449 | .3681 | .3916 | .4154 | .4394 | .4636 | .4879 | .5124 | .5368 | .5612 |
| 0.0000 | .0012 | .0047 | .0105 | .0185 | .0287 | .0408 | .0547 | .0702 | .0871 |
| .1052 | .1243 | .1441 | .1643 | .1847 | .2051 | .2252 | .2449 | .2639 | .2831 |
| .3025 | .3221 | .3420 | .3620 | .3821 | .4024 | .4227 | .4431 | .4634 | .4837 |
| 0.0000 | .0010 | .0038 | .0085 | .0151 | .0233 | .0332 | .0446 | .0574 | .0714 |
| .0864 | .1024 | .1192 | .1365 | .1543 | .1723 | .1905 | .2085 | .2262 | .2434 |
| .2597 | .2760 | .2924 | .3088 | .3253 | .3419 | .3584 | .3749 | .3914 | .4078 |
| 0.0000 | .0004 | .0016 | .0036 | .0064 | .0100 | .0144 | .0195 | .0253 | .0318 |
| .0389 | .0467 | .0551 | .0640 | .0734 | .0833 | .0936 | .1043 | .1154 | .1267 |
| .1355 | .1444 | .1533 | .1624 | .1715 | .1806 | .1898 | .1990 | .2082 | .2173 |
| 0.0000 | .1866 | .3670 | .5412 | .7088 | .8696 | 1.0230 | 1.1685 | 1.3057 | 1.4337 |
| 1.5517 | 1.6588 | 1.7539 | 1.8357 | 1.9029 | 1.9538 | 1.9867 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | .9333 | .6649 | .3668 | .0400 |
| 0.0000 | .2168 | .4199 | .6094 | .7856 | .9490 | 1.1001 | 1.2393 | 1.3674 | 1.4845 |
| 1.5912 | 1.6873 | 1.7727 | 1.8466 | 1.9081 | 1.9555 | 1.9870 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | .9333 | .6649 | .3668 | .0400 |
| 0.0000 | .2432 | .4660 | .6689 | .8527 | 1.0184 | 1.1674 | 1.3012 | 1.4212 | 1.5290 |
| 1.6257 | 1.7122 | 1.7891 | 1.8561 | 1.9126 | 1.9571 | 1.9872 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | .9333 | .6649 | .3668 | .0400 |
| 0.0000 | .2657 | .5054 | .7197 | .9099 | 1.0776 | 1.2249 | 1.3540 | 1.4672 | 1.5669 |
| 1.6551 | 1.7335 | 1.8031 | 1.8642 | 1.9165 | 1.9584 | 1.9874 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | .9333 | .6649 | .3668 | .0400 |
| 0.0000 | .2844 | .5381 | .7619 | .9574 | 1.1268 | 1.2726 | 1.3978 | 1.5054 | 1.5984 |
| 1.6795 | 1.7511 | 1.8147 | 1.8710 | 1.9198 | 1.9596 | 1.9876 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | .9333 | .6649 | .3668 | .0400 |
| 0.0000 | .2993 | .5640 | .7954 | .9951 | 1.1658 | 1.3104 | 1.4325 | 1.5357 | 1.6234 |
| 1.6989 | 1.7651 | 1.8239 | 1.8763 | 1.9223 | 1.9604 | 1.9878 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | .9333 | .6649 | .3668 | .0400 |
| 0.0000 | .3103 | .5833 | .8202 | 1.0231 | 1.1947 | 1.3385 | 1.4583 | 1.5581 | 1.6419 |
| 1.7133 | 1.7755 | 1.8307 | 1.8803 | 1.9242 | 1.9611 | 1.9879 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | .9333 | .6649 | .3668 | .0400 |
| 0.0000 | .3174 | .5958 | .8363 | 1.0412 | 1.2135 | 1.3568 | 1.4751 | 1.5727 | 1.6539 |
| 1.7226 | 1.7822 | 1.8351 | 1.8829 | 1.9255 | 1.9615 | 1.9879 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | .9333 | .6649 | .3668 | .0400 |
| 0.0000 | .3207 | .6016 | .8438 | 1.0496 | 1.2222 | 1.3652 | 1.4828 | 1.5795 | 1.6595 |
| 1.7269 | 1.7853 | 1.8372 | 1.8841 | 1.9260 | 1.9617 | 1.9880 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | .9333 | .6649 | .3668 | .0400 |

```
0.0000  .3210  .6020  .8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712  .9333  .6649  .3668  .0400
0.0000  .3210  .6020  .8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712  .9333  .6649  .3668  .0400
0.0000  .3210  .6020  .8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712  .9333  .6649  .3668  .0400
0.0000  .3210  .6020  .8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712  .9333  .6649  .3668  .0400
0.0000  .3210  .6020  .8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712  .9333  .6649  .3668  .0400
0.0000  .3210  .6020  .8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712  .9333  .6649  .3668  .0400
0.0000  .3210  .6020  .8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712  .9333  .6649  .3668  .0400
0.0000  .3210  .6020  .8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712  .9333  .6649  .3668  .0400
0.0000  .3210  .6020  .8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712  .9333  .6649  .3668  .0400
0.0000  .3210  .6020  .8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712  .9333  .6649  .3668  .0400
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
        *** END OF AIRFOIL DATA ***
        *** END OF FUSELAGE DATA ***
        *** INPUT DATA FOR AIRCRAFT HAS BEEN COMPLETED ***
*** SPLINE AND SURFACE PATCHES HAS BEEN COMPLETED ***
        NOBJ=    1
WING
        NSURF=    2
        NUMBER OF PATCHES=  551
        NUMBER OF PATCHES=  551
        *** CORNER POINTS OF PATCHES HAVE BEEN COMPUTED AND STORED AS COMMON PATBLK ***


    LEADING EDGE PANEL DETECTED AT NXLE=   33 ON SURFACE    1
***   39 PATCHES FOR XCUT ON SURFACE    1 ***
***   39 PATCHES FOR XCUT ON SURFACE    2 ***
    XTIP=  19.90000  YTIP=  10.38742  ZTIP=   -.21985
```

SPANWISE SECTION GEOMETRY FROM CRAIDON GEOMETRY PACKAGE

XSTN= 19.90000 ZAVG= .00000 DALP= -.00 DEGREES

CENTERLINE AVERAGE VALUE

IF ZAVG IS NOT ZERO, THE SECTION IS TRANSLATED TO KEEP THE SPANWISE SECTION AT THE COORDINATE SYSTEM ORIGIN, AND THE ANGLE OF ATTACK IS CHANGED BY DALP TO ACCOUNT FOR THE TRANSLATION.

| I | YHARL | Z | DNY | DNZ | DNX | XSTN | YD | ZD |
|---|---|---|---|---|---|---|---|---|
| 1 | .00000 | -.01416 | -.16186 | .98572 | -.04639 | 19.90000 | .00000 | -.22643 |
| 2 | .03457 | -.00843 | -.16555 | .98517 | -.04517 | 19.90000 | .55284 | -.13489 |
| 3 | .06904 | -.00248 | -.17481 | .98366 | -.04317 | 19.90000 | 1.10412 | -.03968 |
| 4 | .10331 | .00374 | -.18137 | .98256 | -.04112 | 19.90000 | 1.65226 | .05985 |
| 5 | .13729 | .00995 | -.17513 | .98371 | -.04051 | 19.90000 | 2.19572 | .15910 |
| 6 | .17088 | .01556 | -.15178 | .98750 | -.04241 | 19.90000 | 2.73296 | .24881 |
| 7 | .20399 | .02001 | -.11303 | .99242 | -.04817 | 19.90000 | 3.26245 | .32003 |
| 8 | .23652 | .02290 | -.06366 | .99631 | -.05764 | 19.90000 | 3.78269 | .36631 |
| 9 | .26838 | .02409 | -.01386 | .99758 | -.06807 | 19.90000 | 4.29221 | .38530 |
| 10 | .29948 | .02389 | .02505 | .99670 | -.07722 | 19.90000 | 4.78956 | .38215 |
| 11 | .32973 | .02263 | .05865 | .99461 | -.08549 | 19.90000 | 5.27334 | .36185 |
| 12 | .35904 | .02046 | .08752 | .99186 | -.09251 | 19.90000 | 5.74217 | .32729 |
| 13 | .38734 | .01764 | .10948 | .98919 | -.09752 | 19.90000 | 6.19472 | .28207 |
| 14 | .41454 | .01435 | .12688 | .98675 | -.10116 | 19.90000 | 6.62971 | .22954 |
| 15 | .44056 | .01088 | .13583 | .98542 | -.10245 | 19.90000 | 7.04591 | .17394 |
| 16 | .46534 | .00740 | .13927 | .98495 | -.10233 | 19.90000 | 7.44214 | .11837 |
| 17 | .48879 | .00411 | .13653 | .98558 | -.09991 | 19.90000 | 7.81727 | .06579 |
| 18 | .51086 | .00109 | .13255 | .98642 | -.09703 | 19.90000 | 8.17024 | .01748 |
| 19 | .53149 | -.00162 | .12704 | .98743 | -.09399 | 19.90000 | 8.50005 | -.02584 |
| 20 | .55060 | -.00407 | .12616 | .98761 | -.09336 | 19.90000 | 8.80577 | -.06504 |
| 21 | .56816 | -.00629 | .12393 | .98800 | -.09220 | 19.90000 | 9.08653 | -.10066 |
| 22 | .58410 | -.00829 | .12614 | .98755 | -.09398 | 19.90000 | 9.34153 | -.13252 |
| 23 | .59839 | -.01024 | .14477 | .98388 | -.10502 | 19.90000 | 9.57005 | -.16378 |
| 24 | .61098 | -.01220 | .15778 | .98099 | -.11301 | 19.90000 | 9.77145 | -.19505 |
| 25 | .62184 | -.01395 | .15811 | .98092 | -.11315 | 19.90000 | 9.94514 | -.22313 |
| 26 | .63094 | -.01536 | .14154 | .98470 | -.10168 | 19.90000 | 10.09065 | -.24568 |
| 27 | .63825 | -.01628 | .09579 | .99286 | -.07106 | 19.90000 | 10.20755 | -.26033 |
| 28 | .64375 | -.01657 | -.00729 | .99997 | -.00311 | 19.90000 | 10.29552 | -.26506 |
| 29 | .64743 | -.01607 | -.30488 | .93290 | .19167 | 19.90000 | 10.35430 | -.25708 |
| 30 | .64927 | -.01466 | -.79785 | .31255 | .51552 | 19.90000 | 10.38374 | -.23450 |
| 31 | .64950 | -.01375 | -.82437 | .18948 | .53339 | 19.90000 | 10.38742 | -.21985 |
| 32 | .64927 | -.01271 | .81048 | .25748 | -.52614 | 19.90000 | 10.38374 | -.20328 |
| 33 | .64743 | -.01023 | .60934 | .68689 | -.39609 | 19.90000 | 10.35430 | -.16362 |
| 34 | .64375 | -.00767 | .46671 | .83104 | -.30258 | 19.90000 | 10.29552 | -.12271 |
| 35 | .63825 | -.00498 | .38733 | .88739 | -.25002 | 19.90000 | 10.20755 | -.07960 |
| 36 | .63094 | -.00213 | .32688 | .92156 | -.20947 | 19.90000 | 10.09065 | -.03403 |
| 37 | .62184 | .00086 | .28694 | .94047 | -.18217 | 19.90000 | 9.94514 | .01371 |
| 38 | .61098 | .00396 | .25664 | .95303 | -.16083 | 19.90000 | 9.77145 | .06332 |
| 39 | .59839 | .00714 | .22681 | .96378 | -.14032 | 19.90000 | 9.57005 | .11414 |
| 40 | .58410 | .01027 | .19953 | .97224 | -.12224 | 19.90000 | 9.34153 | .16421 |
| 41 | .56816 | .01344 | .19152 | .97469 | -.11532 | 19.90000 | 9.08653 | .21494 |
| 42 | .55060 | .01687 | .18882 | .97566 | -.11156 | 19.90000 | 8.80577 | .26975 |
| 43 | .53149 | .02052 | .18464 | .97701 | -.10657 | 19.90000 | 8.50005 | .32821 |
| 44 | .51086 | .02441 | .18386 | .97762 | -.10225 | 19.90000 | 8.17024 | .39035 |
| 45 | .48879 | .02853 | .18059 | .97885 | -.09615 | 19.90000 | 7.81727 | .45623 |
| 46 | .46534 | .03281 | .17690 | .98016 | -.08937 | 19.90000 | 7.44214 | .52469 |
| 47 | .44056 | .03717 | .16811 | .98245 | -.08076 | 19.90000 | 7.04591 | .59452 |
| 48 | .41454 | .04145 | .15459 | .98542 | -.07108 | 19.90000 | 6.62971 | .66289 |
| 49 | .38734 | .04544 | .13286 | .98935 | -.05952 | 19.90000 | 6.19472 | .72671 |
| 50 | .35904 | .04888 | .10686 | .99316 | -.04715 | 19.90000 | 5.74217 | .78167 |
| 51 | .32973 | .05154 | .07366 | .99673 | -.03320 | 19.90000 | 5.27334 | .82423 |
| 52 | .29948 | .05319 | .03574 | .99919 | -.01851 | 19.90000 | 4.78956 | .85073 |

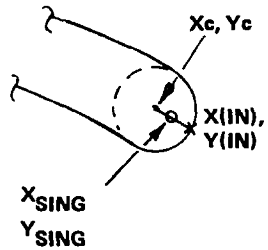
| I | YHARL | Z | DNY | DNZ | DNX | XSTN | YD | ZD |
|---|---|---|---|---|---|---|---|---|
| 53 | .26838 | .05366 | -.00716 | .99997 | -.00368 | 19.90000 | 4.29221 | .85817 |
| 54 | .23652 | .05263 | -.06077 | .99808 | .01185 | 19.90000 | 3.78269 | .84164 |
| 55 | .20399 | .04978 | -.11328 | .99323 | .02561 | 19.90000 | 3.26245 | .79608 |
| 56 | .17088 | .04527 | -.15463 | .98735 | .03514 | 19.90000 | 2.73296 | .72402 |
| 57 | .13729 | .03952 | -.18027 | .98279 | .04040 | 19.90000 | 2.19572 | .63203 |
| 58 | .10331 | .03309 | -.18844 | .98115 | .04296 | 19.90000 | 1.65226 | .52927 |
| 59 | .06904 | .02658 | -.18357 | .98202 | .04405 | 19.90000 | 1.10412 | .42514 |
| 60 | .03457 | .02028 | -.17590 | .98338 | .04494 | 19.90000 | .55284 | .32435 |
| 61 | .00000 | .01416 | -.17357 | .98373 | .04630 | 19.90000 | .00000 | .22643 |

YHARL IS TAKEN TO BE A 61 POINT COSINE SPACING CHOSEN TO CONCENTRATE POINTS AT THE L.E. OF THE SPANWISE SECTION.

INTERNALLY GENERATED SINGULARITY LOCATION FOR MAPPING

GENERATED FROM PARM:
X(IN), Y(IN): THE POINT ON THE SECTION WITH THE SMALLEST RADIUS OF CURVATURE.
XC, YC: THE ORIGIN OF THE L.E. RADIUS

| | | | | |
|---|---|---|---|---|
| X(IN)= | .64918 | Y(IN)= | -.01473 | IN= 60 |
| XC= | .64732 | YC= | -.01379 | |
| XSING= | .64825 | YSING= | -.01426 | |




XSING= .99822 YSING= -.02196 XAREA= .016988

NORMALIZED BY $X_{LE}$

CROSS SECTIONAL AREA OF THE SPANWISE SECTION

X0= .64825 Y0= -.014260 Y1= .014260 NM= 58

XSING, YSING IS THE MIDPOINT OF THE LINE CONNECTING THE CENTER OF THE CIRCLE AND THE TANGENT POINT OF THE CIRCLE TO THE SPANWISE SECTION.

MAPPED BODY (B) AND SHOCK (C) LOCATIONS - WITH 1ST (PR) AND 2ND (SEC) DERIVATIVES

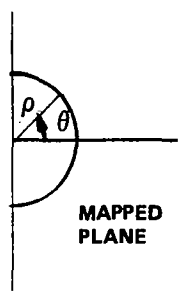
| | | BODY LOCATION | | | ASSUMED BOW SHOCK LOCATION | | |
|---|---|---|---|---|---|---|---|
| I | X | B | BPR | BSEC | C | CPR | CSEC |
| 2 | -.15708E+01 | .33265E+00 | 0. | -.10047E+01 | .13554E+01 | 0. | .57343E-01 |
| 3 | -.14586E+01 | .32632E+00 | -.59303E-01 | -.52367E-01 | .13557E+01 | -.71327E-03 | -.70057E-01 |
| 4 | -.13464E+01 | .31934E+00 | -.58877E-01 | .59949E-01 | .13552E+01 | -.69877E-02 | -.41788E-01 |
| 5 | -.12342E+01 | .31311E+00 | -.43504E-01 | .21409E+00 | .13542E+01 | -.10481E-01 | -.20488E-01 |
| 6 | -.11220E+01 | .30958E+00 | -.19378E-01 | .21596E+00 | .13529E+01 | -.10162E-01 | .26188E-01 |
| 7 | -.10098E+01 | .30876E+00 | .15004E-02 | .15620E+00 | .13519E+01 | -.40285E-02 | .83138E-01 |
| 8 | -.89760E+00 | .30992E+00 | .16013E-01 | .10249E+00 | .13520E+01 | .84379E-02 | .13908E+00 |
| 9 | -.78540E+00 | .31236E+00 | .23252E-01 | .26552E-01 | .13538E+01 | .27389E-01 | .19872E+00 |
| 10 | -.67320E+00 | .31513E+00 | .23597E-01 | -.20397E-01 | .13581E+01 | .52861E-01 | .25533E+00 |
| 11 | -.56100E+00 | .31765E+00 | .21913E-01 | -.96187E-02 | .13656E+01 | .84885E-01 | .31550E+00 |
| 12 | -.44880E+00 | .32005E+00 | .26358E-01 | .88847E-01 | .13771E+01 | .12317E+00 | .36691E+00 |
| 13 | -.33660E+00 | .32357E+00 | .42010E-01 | .19015E+00 | .13933E+01 | .16713E+00 | .41680E+00 |
| 14 | -.22440E+00 | .32948E+00 | .61776E-01 | .16219E+00 | .14147E+01 | .21600E+00 | .45418E+00 |
| 15 | -.11220E+00 | .33743E+00 | .63611E-01 | -.12948E+00 | .14417E+01 | .26927E+00 | .49551E+00 |
| 16 | -.71054E-14 | .34375E+00 | .51667E-01 | -.83429E-01 | .14751E+01 | .32324E+00 | .46655E+00 |
| 17 | .11220E+00 | .34902E+00 | .30698E-01 | -.29035E+00 | .15143E+01 | .37466E+00 | .44988E+00 |
| 18 | .22440E+00 | .35064E+00 | .12845E-01 | -.27893E-01 | .15592E+01 | .41834E+00 | .32874E+00 |
| 19 | .33660E+00 | .35191E+00 | .90962E-02 | -.38926E-01 | .16082E+01 | .44975E+00 | .23122E+00 |
| 20 | .44880E+00 | .35268E+00 | .97841E-02 | .51188E-01 | .16601E+01 | .46834E+00 | .10017E+00 |
| 21 | .56100E+00 | .35410E+00 | .16058E-01 | .60647E-01 | .17133E+01 | .47294E+00 | -.18230E-01 |
| 22 | .67320E+00 | .35629E+00 | .21011E-01 | .27643E-01 | .17662E+01 | .46342E+00 | -.15147E+00 |
| 23 | .78540E+00 | .35882E+00 | .20238E-01 | -.41415E-01 | .18172E+01 | .43878E+00 | -.28763E+00 |
| 24 | .89760E+00 | .36083E+00 | .10853E-01 | -.12589E+00 | .18647E+01 | .40146E+00 | -.37775E+00 |
| 25 | .10098E+01 | .36125E+00 | -.67568E-02 | -.18801E+00 | .19073E+01 | .35583E+00 | -.43554E+00 |
| 26 | .11220E+01 | .35931E+00 | -.31540E-01 | -.25377E+00 | .19445E+01 | .30382E+00 | -.49163E+00 |
| 27 | .12342E+01 | .35417E+00 | -.57190E-01 | -.20345E+00 | .19755E+01 | .24442E+00 | -.56707E+00 |
| 28 | .13464E+01 | .34648E+00 | -.69707E-01 | -.19685E-01 | .19994E+01 | .17532E+00 | -.66475E+00 |
| 29 | .14586E+01 | .33853E+00 | -.66197E-01 | .82267E-01 | .20148E+01 | .96017E-01 | -.74880E+00 |
| 30 | .15708E+01 | .33162E+00 | 0. | .10977E+01 | .20209E+01 | 0. | -.96274E+00 |
| I | X | B | BPR | BSEC | C | CPR | CSEC |

B < C ALWAYS

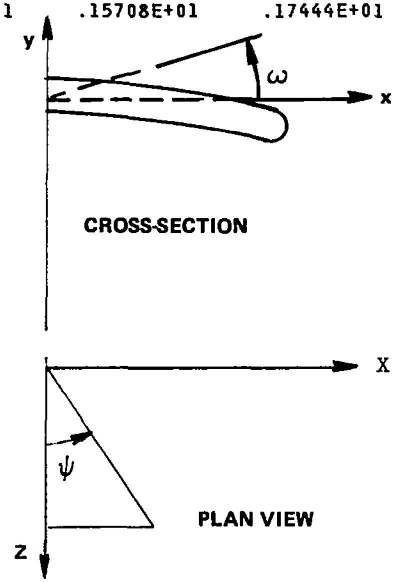
MAPPING METRIC AND FREESTREAM VELOCITIES AT GRID POINTS

NOTE: THE JOUKOWSKI MAPPING LEADS TO A NEAR CIRCLE, SO THAT B IS NOT A CONSTANT IN THE MAPPED SPACE.

| | | MAPPED PLANE | | PHYSICAL PLANE | | MAPPING METRIC | FREESTREAM VELOCITIES | | |
|---|---|---|---|---|---|---|---|---|---|
| I | J | RHO | THE | PSI | OMEG | H | UI | VI | WI |
| 2 | 2 | .33265E+00 | -.15708E+01 | .14155E-01 | -.15708E+01 | .18209E+01 | .12312E-14 | -.22174E+00 | .97511E+00 |
| 3 | 2 | .32632E+00 | -.14586E+01 | .67881E-01 | -.39586E-01 | .18428E+01 | -.67280E-01 | -.21022E+00 | .97534E+00 |
| 4 | 2 | .31934E+00 | -.13464E+01 | .13508E+00 | .71027E-01 | .18407E+01 | -.13445E+00 | -.19659E+00 | .97122E+00 |
| 5 | 2 | .31311E+00 | -.12342E+01 | .20070E+00 | .97679E-01 | .18059E+01 | -.19996E+00 | -.18304E+00 | .96256E+00 |
| 6 | 2 | .30958E+00 | -.11220E+01 | .26277E+00 | .89595E-01 | .17269E+01 | -.26184E+00 | -.17342E+00 | .94940E+00 |
| 7 | 2 | .30876E+00 | -.10098E+01 | .32034E+00 | .68000E-01 | .16068E+01 | -.31854E+00 | -.16837E+00 | .93283E+00 |
| 8 | 2 | .30992E+00 | -.89760E+00 | .37295E+00 | .44056E-01 | .14559E+01 | -.36915E+00 | -.16700E+00 | .91424E+00 |
| 9 | 2 | .31236E+00 | -.78540E+00 | .42019E+00 | .22401E-01 | .12840E+01 | -.41308E+00 | -.16856E+00 | .89496E+00 |
| 10 | 2 | .31513E+00 | -.67320E+00 | .46172E+00 | .58178E-02 | .11011E+01 | -.45034E+00 | -.17135E+00 | .87626E+00 |
| 11 | 2 | .31765E+00 | -.56100E+00 | .49717E+00 | -.56375E-02 | .91293E+00 | -.48114E+00 | -.17418E+00 | .85917E+00 |
| 12 | 2 | .32005E+00 | -.44880E+00 | .52622E+00 | -.13566E-01 | .72156E+00 | -.50529E+00 | -.17797E+00 | .84440E+00 |
| 13 | 2 | .32357E+00 | -.33660E+00 | .54862E+00 | -.19970E-01 | .52693E+00 | -.52023E+00 | -.19083E+00 | .83244E+00 |
| 14 | 2 | .32948E+00 | -.22440E+00 | .56433E+00 | -.24708E-01 | .33308E+00 | -.51507E+00 | -.23699E+00 | .82373E+00 |
| 15 | 2 | .33743E+00 | -.11220E+00 | .57352E+00 | -.25427E-01 | .15624E+00 | -.41163E+00 | -.40022E+00 | .81877E+00 |
| 16 | 2 | .34375E+00 | -.71054E-14 | .57604E+00 | -.20627E-01 | .99749E-01 | .38659E+00 | -.42600E+00 | .81796E+00 |
| 17 | 2 | .34902E+00 | .11220E+00 | .57183E+00 | -.11807E-01 | .24009E+00 | .56409E+00 | -.86176E-01 | .82121E+00 |
| 18 | 2 | .35064E+00 | .22440E+00 | .56056E+00 | -.16665E-02 | .39910E+00 | .55990E+00 | .22197E-01 | .82827E+00 |
| 19 | 2 | .35191E+00 | .33660E+00 | .54267E+00 | .99505E-02 | .55922E+00 | .54027E+00 | .68589E-01 | .83869E+00 |
| 20 | 2 | .35268E+00 | .44880E+00 | .51831E+00 | .22866E-01 | .71587E+00 | .51478E+00 | .95098E-01 | .85203E+00 |
| 21 | 2 | .35410E+00 | .56100E+00 | .48790E+00 | .39078E-01 | .86535E+00 | .48461E+00 | .10970E+00 | .86782E+00 |
| 22 | 2 | .35629E+00 | .67320E+00 | .45182E+00 | .60445E-01 | .10045E+01 | .44955E+00 | .11763E+00 | .88548E+00 |
| 23 | 2 | .35882E+00 | .78540E+00 | .41045E+00 | .88278E-01 | .11315E+01 | .40918E+00 | .12232E+00 | .90422E+00 |
| 24 | 2 | .36083E+00 | .89760E+00 | .36411E+00 | .12263E+00 | .12469E+01 | .36323E+00 | .12646E+00 | .92308E+00 |
| 25 | 2 | .36125E+00 | .10098E+01 | .31305E+00 | .16203E+00 | .13524E+01 | .31174E+00 | .13211E+00 | .94094E+00 |
| 26 | 2 | .35931E+00 | .11220E+01 | .25755E+00 | .20450E+00 | .14501E+01 | .25520E+00 | .14041E+00 | .95664E+00 |
| 27 | 2 | .35417E+00 | .12342E+01 | .19780E+00 | .24506E+00 | .15431E+01 | .19437E+00 | .15259E+00 | .96899E+00 |
| 28 | 2 | .34648E+00 | .13464E+01 | .13455E+00 | .28569E+00 | .16297E+01 | .13056E+00 | .16763E+00 | .97717E+00 |
| 29 | 2 | .33853E+00 | .14586E+01 | .69789E-01 | .37816E+00 | .16995E+01 | .65345E-01 | .18203E+00 | .98112E+00 |
| 30 | 2 | .33162E+00 | .15708E+01 | .14155E-01 | .15708E+01 | .17444E+01 | .11382E-13 | .19405E+00 | .98099E+00 |




MAPPED PLANE



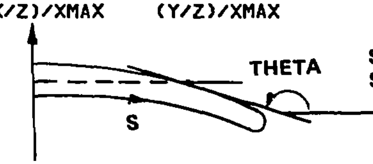

CROSS-SECTION

PLAN VIEW

NOTE THAT THE PROGRAM OPERATES AT A UNIT DISTANCE FROM THE ORIGIN, Z=1.

SURFACE ARC LENGTH (S) SLOPE (THETA) AND CURVATURE (PSI)

| I | X/Z | Y/Z | S | THETA | PSI | (X/Z)/XMAX | (Y/Z)/XMAX | DYBP/DZP |
|---|---|---|---|---|---|---|---|---|
| 1 | -.00000 | -.01416 | 0.00000 | 9.19264 | .31414 | -.00000 | -.02180 | -.22360 |
| 2 | .06793 | -.00269 | .06889 | 9.95043 | .03245 | .10461 | -.00414 | -.22405 |
| 3 | .13556 | .00964 | .13764 | 9.45096 | -.46571 | .20876 | .01485 | -.22236 |
| 4 | .20247 | .01984 | .20533 | 5.60673 | -1.08595 | .31179 | .03055 | -.20948 |
| 5 | .26791 | .02407 | .27093 | 1.10677 | -1.11797 | .41257 | .03706 | -.19055 |
| 6 | .33100 | .02254 | .33406 | -2.73573 | -1.02233 | .50972 | .03471 | -.17108 |
| 7 | .39088 | .01723 | .39418 | -6.13507 | -.71223 | .60192 | .02654 | -.15019 |
| 8 | .44668 | .01001 | .45045 | -7.67253 | -.15398 | .68786 | .01541 | -.13926 |
| 9 | .49758 | .00289 | .50184 | -7.72597 | .06862 | .76623 | .00446 | -.13904 |
| 10 | .54263 | -.00306 | .54728 | -7.34760 | -.01984 | .83561 | -.00471 | -.14253 |
| 11 | .58080 | -.00788 | .58575 | -7.69958 | -.30916 | .89438 | -.01213 | -.13880 |
| 12 | .61108 | -.01221 | .61634 | -8.61171 | .73202 | .94102 | -.01879 | -.12910 |
| 13 | .63281 | -.01564 | .63835 | -5.02490 | 8.90770 | .97448 | -.02408 | -.16944 |
| 14 | .64574 | -.01642 | .65166 | 28.32868 | 77.08674 | .99439 | -.02529 | -.57398 |
| 15 | .64938 | -.01340 | .65653 | 64.90918 | 136.75686 | 1.00000 | -.02063 | -1.60970 |
| 16 | .64351 | -.00760 | .66581 | 144.55220 | 39.59667 | .99096 | -.01170 | .24109 |
| 17 | .62773 | -.00105 | .68300 | 160.42027 | 6.38028 | .96665 | -.00161 | .01279 |
| 18 | .60303 | .00600 | .70869 | 165.88655 | 1.95459 | .92862 | .00924 | -.05182 |
| 19 | .57017 | .01304 | .74231 | 168.45740 | .62664 | .87801 | .02008 | -.07996 |
| 20 | .53029 | .02073 | .78292 | 169.23119 | .23402 | .81660 | .03193 | -.08785 |
| 21 | .48442 | .02932 | .82959 | 169.65527 | .23377 | .74597 | .04514 | -.09170 |
| 22 | .43347 | .03837 | .88133 | 170.72479 | .52468 | .66751 | .05908 | -.10028 |
| 23 | .37824 | .04662 | .93718 | 173.18175 | .93847 | .58246 | .07179 | -.11760 |
| 24 | .31946 | .05222 | .99624 | 177.31196 | 1.21130 | .49194 | .08041 | -.14222 |
| 25 | .25792 | .05349 | 1.05782 | 181.55226 | 1.24687 | .39717 | .08237 | -.16294 |
| 26 | .19443 | .04862 | 1.12151 | 186.30045 | 1.11588 | .29940 | .07488 | -.18228 |
| 27 | .12988 | .03815 | 1.18691 | 189.95137 | .46051 | .20001 | .05875 | -.19408 |
| 28 | .06496 | .02581 | 1.25299 | 190.46088 | -.01128 | .10004 | .03974 | -.19562 |
| 29 | .00000 | .01416 | 1.31900 | 189.86743 | -.26637 | .00000 | .02180 | -.19528 |
| I | X/Z | Y/Z | S | THETA | PSI | (X/Z)/XMAX | (Y/Z)/XMAX | DYBP/DZP |
| | | | ARC LENGTH FROM BOTTOM OF SECTION | SURFACE SLOPE | CURVATURE | | | STREAMWISE SLOPE |




SMAX= 1.31900 XMAX= .64938 SMAX/XMAX= 2.03115

SLOR SOLUTION ITERATION BEGINS ON MESH 1

NO. OF POINTS VIOLATING DIAGONAL DOMINANCE — NPVD; MAX SHOCK — JSHMAX, ISHMAX; MIN SHOCK — JSHMIN, ISHMIN; EDGE OF COMPUTATIONAL GRID — KSUP/JSHMAX 28

| ITER | DELMX | I | J | DELAVG | RESMX | I | J | RESAVG | KSUP | NPVD | JSHMAX | ISHMAX | JSHMIN | ISHMIN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .1103E-01 | 30 | 2 | .3008E-03 | -.1111E+02 | 4 | 2 | .1685E+00 | 525 | 0 | 28 | 0 | 0 | 0 |
| 2 | .6625E-02 | 30 | 2 | .2484E-03 | -.5506E+01 | 2 | 2 | .1172E+00 | 528 | 0 | 28 | 0 | 0 | 0 |
| 3 | .5177E-02 | 29 | 2 | .2226E-03 | .3227E+01 | 30 | 2 | .9971E-01 | 528 | 0 | 28 | 0 | 0 | 0 |
| 4 | .4283E-02 | 30 | 2 | .2068E-03 | .2579E+01 | 30 | 2 | .8992E-01 | 530 | 0 | 28 | 0 | 0 | 0 |
| 5 | .3622E-02 | 30 | 2 | .1931E-03 | .2126E+01 | 30 | 2 | .8291E-01 | 532 | 0 | 28 | 0 | 0 | 0 |
| 6 | .3155E-02 | 30 | 2 | .1839E-03 | .1821E+01 | 30 | 2 | .7740E-01 | 532 | 0 | 28 | 0 | 0 | 0 |
| 7 | .2792E-02 | 30 | 2 | .1761E-03 | .1591E+01 | 30 | 2 | .7288E-01 | 532 | 0 | 28 | 0 | 0 | 0 |
| 8 | .2504E-02 | 30 | 2 | .1694E-03 | -.1417E+01 | 2 | 2 | .6902E-01 | 534 | 0 | 28 | 0 | 0 | 0 |
| 9 | .2269E-02 | 30 | 2 | .1633E-03 | -.1297E+01 | 2 | 2 | .6563E-01 | 534 | 0 | 28 | 0 | 0 | 0 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | .2073E-02 | 30 | 2 | .1577E-03 | -.1198E+01 | 2 | 2 | .6265E-01 | 534 | 0 | 28 | 0 | 0 | 0 |
| 11 | .1908E-02 | 30 | 2 | .1525E-03 | -.1112E+01 | 2 | 2 | .5999E-01 | 534 | 0 | 28 | 0 | 0 | 0 |
| 12 | .1765E-02 | 30 | 2 | .1476E-03 | -.1036E+01 | 2 | 2 | .5757E-01 | 534 | 0 | 28 | 0 | 0 | 0 |
| 13 | .1641E-02 | 30 | 2 | .1430E-03 | -.9680E+00 | 2 | 2 | .5538E-01 | 535 | 0 | 28 | 0 | 0 | 0 |
| 14 | .1532E-02 | 30 | 2 | .1381E-03 | -.9064E+00 | 2 | 2 | .5330E-01 | 534 | 0 | 28 | 0 | 0 | 0 |
| 15 | .1435E-02 | 30 | 2 | .1338E-03 | -.8503E+00 | 2 | 2 | .5139E-01 | 535 | 0 | 28 | 0 | 0 | 0 |
| 16 | .1349E-02 | 30 | 2 | .1301E-03 | -.7992E+00 | 2 | 2 | .4963E-01 | 536 | 0 | 28 | 0 | 0 | 0 |
| 17 | .1271E-02 | 30 | 2 | .1265E-03 | -.7525E+00 | 2 | 2 | .4797E-01 | 535 | 0 | 28 | 0 | 0 | 0 |
| 18 | .1201E-02 | 30 | 2 | .1230E-03 | -.7098E+00 | 2 | 2 | .4642E-01 | 535 | 0 | 28 | 0 | 0 | 0 |
| 19 | .1137E-02 | 30 | 2 | .1198E-03 | -.6707E+00 | 2 | 2 | .4498E-01 | 534 | 0 | 28 | 0 | 0 | 0 |
| 20 | .1079E-02 | 30 | 2 | .1166E-03 | -.6349E+00 | 2 | 2 | .4362E-01 | 535 | 0 | 28 | 0 | 0 | 0 |
| 21 | .1025E-02 | 30 | 2 | .1136E-03 | -.6021E+00 | 2 | 2 | .4232E-01 | 534 | 0 | 28 | 0 | 0 | 0 |
| 22 | .9750E-03 | 30 | 2 | .1103E-03 | -.5718E+00 | 2 | 2 | .4096E-01 | 535 | 0 | 28 | 0 | 0 | 0 |
| 23 | .9289E-03 | 30 | 2 | .1074E-03 | -.5440E+00 | 2 | 2 | .3977E-01 | 534 | 0 | 28 | 0 | 0 | 0 |
| 24 | .8859E-03 | 30 | 2 | .1046E-03 | -.5186E+00 | 3 | 2 | .3865E-01 | 531 | 0 | 28 | 0 | 0 | 0 |
| 25 | .8457E-03 | 30 | 2 | .1020E-03 | -.4953E+00 | 3 | 2 | .3758E-01 | 530 | 0 | 28 | 0 | 0 | 0 |
| 26 | .8080E-03 | 30 | 2 | .9936E-04 | -.4737E+00 | 3 | 2 | .3654E-01 | 529 | 0 | 28 | 0 | 0 | 0 |
| 27 | .7725E-03 | 30 | 2 | .9678E-04 | -.4536E+00 | 3 | 2 | .3554E-01 | 528 | 0 | 28 | 0 | 0 | 0 |
| 28 | .7391E-03 | 30 | 2 | .9424E-04 | -.4349E+00 | 3 | 2 | .3457E-01 | 528 | 0 | 28 | 0 | 0 | 0 |
| 29 | .7075E-03 | 30 | 2 | .9170E-04 | -.4174E+00 | 3 | 2 | .3363E-01 | 528 | 0 | 28 | 0 | 0 | 0 |
| 30 | .6776E-03 | 30 | 2 | .8919E-04 | -.4011E+00 | 3 | 2 | .3271E-01 | 528 | 0 | 28 | 0 | 0 | 0 |
| 31 | .6493E-03 | 30 | 2 | .8672E-04 | -.3857E+00 | 3 | 2 | .3182E-01 | 528 | 0 | 28 | 0 | 0 | 0 |
| 32 | .6225E-03 | 30 | 2 | .8439E-04 | -.3713E+00 | 3 | 2 | .3097E-01 | 529 | 0 | 28 | 0 | 0 | 0 |
| 33 | .5971E-03 | 30 | 2 | .8215E-04 | -.3578E+00 | 3 | 2 | .3015E-01 | 529 | 0 | 28 | 0 | 0 | 0 |
| 34 | .5731E-03 | 30 | 2 | .8004E-04 | -.3450E+00 | 3 | 2 | .2936E-01 | 531 | 0 | 28 | 0 | 0 | 0 |
| 35 | .5504E-03 | 30 | 2 | .7794E-04 | -.3328E+00 | 3 | 2 | .2859E-01 | 528 | 0 | 28 | 0 | 0 | 0 |
| 36 | .5288E-03 | 30 | 2 | .7587E-04 | -.3213E+00 | 3 | 2 | .2784E-01 | 530 | 0 | 28 | 0 | 0 | 0 |
| 37 | .5081E-03 | 30 | 2 | .7380E-04 | -.3104E+00 | 3 | 2 | .2710E-01 | 527 | 0 | 28 | 0 | 0 | 0 |
| 38 | -.4896E-03 | 2 | 2 | .7182E-04 | -.3000E+00 | 3 | 2 | .2639E-01 | 527 | 0 | 28 | 0 | 0 | 0 |
| 39 | -.4729E-03 | 2 | 2 | .6989E-04 | -.2902E+00 | 4 | 2 | .2570E-01 | 527 | 0 | 28 | 0 | 0 | 0 |
| 40 | -.4570E-03 | 2 | 2 | .6796E-04 | -.2810E+00 | 4 | 2 | .2503E-01 | 527 | 0 | 28 | 0 | 0 | 0 |
| 41 | -.4417E-03 | 2 | 2 | .6609E-04 | -.2722E+00 | 4 | 2 | .2436E-01 | 525 | 0 | 28 | 0 | 0 | 0 |
| 42 | -.4271E-03 | 2 | 2 | .6436E-04 | -.2637E+00 | 4 | 2 | .2373E-01 | 525 | 0 | 28 | 0 | 0 | 0 |
| 43 | -.4131E-03 | 2 | 2 | .6260E-04 | -.2556E+00 | 4 | 2 | .2310E-01 | 525 | 0 | 28 | 0 | 0 | 0 |
| 44 | -.3997E-03 | 2 | 2 | .6082E-04 | -.2478E+00 | 4 | 2 | .2249E-01 | 526 | 0 | 28 | 0 | 0 | 0 |
| 45 | -.3868E-03 | 2 | 2 | .5910E-04 | -.2402E+00 | 4 | 2 | .2189E-01 | 525 | 0 | 28 | 0 | 0 | 0 |
| 46 | -.3745E-03 | 2 | 2 | .5740E-04 | -.2330E+00 | 4 | 2 | .2131E-01 | 524 | 0 | 28 | 0 | 0 | 0 |
| 47 | -.3626E-03 | 2 | 2 | .5577E-04 | -.2259E+00 | 4 | 2 | .2078E-01 | 521 | 0 | 28 | 0 | 0 | 0 |
| 48 | -.3512E-03 | 2 | 2 | .5447E-04 | -.2192E+00 | 4 | 2 | .2030E-01 | 521 | 0 | 28 | 0 | 0 | 0 |
| 49 | -.3405E-03 | 2 | 2 | .5303E-04 | -.2128E+00 | 4 | 2 | .1974E-01 | 521 | 0 | 28 | 0 | 0 | 0 |
| 50 | -.3304E-03 | 2 | 2 | .5187E-04 | -.2068E+00 | 4 | 2 | .1925E-01 | 521 | 0 | 16 | 30 | 9 | 13 |
| 51 | -.3210E-03 | 2 | 2 | .1270E-03 | -.2011E+00 | 4 | 2 | .4681E-01 | 229 | 0 | 16 | 30 | 9 | 13 |
| 52 | -.3125E-03 | 2 | 2 | .1256E-03 | -.1960E+00 | 4 | 2 | .4599E-01 | 229 | 0 | 16 | 30 | 9 | 13 |
| 53 | -.3050E-03 | 2 | 2 | .1234E-03 | -.1913E+00 | 4 | 2 | .4514E-01 | 228 | 0 | 16 | 30 | 9 | 13 |
| 54 | -.2984E-03 | 2 | 2 | .1210E-03 | -.1872E+00 | 4 | 2 | .4427E-01 | 228 | 0 | 16 | 30 | 9 | 14 |
| 55 | -.2926E-03 | 2 | 2 | .1179E-03 | -.1835E+00 | 4 | 2 | .4328E-01 | 227 | 0 | 16 | 30 | 9 | 14 |
| 56 | -.2874E-03 | 2 | 2 | .1148E-03 | -.1801E+00 | 4 | 2 | .4234E-01 | 227 | 0 | 16 | 30 | 9 | 14 |
| 57 | -.2826E-03 | 2 | 2 | .1115E-03 | -.1770E+00 | 4 | 2 | .4134E-01 | 227 | 0 | 16 | 30 | 9 | 14 |
| 58 | -.2779E-03 | 2 | 2 | .1082E-03 | -.1740E+00 | 4 | 2 | .4029E-01 | 226 | 0 | 16 | 30 | 9 | 14 |
| 59 | -.2734E-03 | 2 | 2 | .1052E-03 | -.1711E+00 | 4 | 2 | .3933E-01 | 226 | 0 | 16 | 30 | 9 | 14 |
| 60 | -.2689E-03 | 2 | 2 | .1024E-03 | -.1682E+00 | 4 | 2 | .3838E-01 | 227 | 0 | 16 | 30 | 9 | 14 |
| 61 | -.2643E-03 | 2 | 2 | .9955E-04 | -.1653E+00 | 4 | 2 | .3742E-01 | 227 | 0 | 16 | 30 | 9 | 14 |
| 62 | -.2597E-03 | 2 | 2 | .9695E-04 | -.1624E+00 | 4 | 2 | .3660E-01 | 227 | 0 | 16 | 30 | 9 | 14 |
| 63 | -.2550E-03 | 2 | 2 | .9412E-04 | -.1596E+00 | 4 | 2 | .3567E-01 | 228 | 0 | 16 | 30 | 9 | 14 |
| 64 | -.2503E-03 | 2 | 2 | .9142E-04 | -.1567E+00 | 4 | 2 | .3470E-01 | 228 | 0 | 16 | 30 | 9 | 15 |
| 65 | -.2456E-03 | 2 | 2 | .8867E-04 | -.1538E+00 | 4 | 2 | .3378E-01 | 226 | 0 | 16 | 30 | 9 | 15 |
| 66 | -.2409E-03 | 2 | 2 | .8639E-04 | -.1509E+00 | 4 | 2 | .3293E-01 | 226 | 0 | 16 | 30 | 9 | 15 |
| 67 | -.2361E-03 | 2 | 2 | .8405E-04 | -.1480E+00 | 4 | 2 | .3209E-01 | 225 | 0 | 16 | 30 | 9 | 15 |
| 68 | -.2313E-03 | 2 | 2 | .8176E-04 | -.1450E+00 | 4 | 2 | .3124E-01 | 224 | 0 | 16 | 30 | 9 | 15 |
| 69 | -.2266E-03 | 2 | 2 | .7965E-04 | -.1421E+00 | 4 | 2 | .3043E-01 | 224 | 0 | 16 | 30 | 9 | 15 |

SHOULD BE ABOUT THE SAME

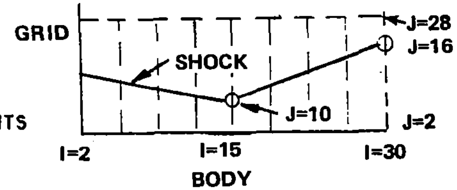
START TEST AFTER 50 ITERATIONS

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 70 | -.2218E-03 | 2 | 2 | .7757E-04 | -.1392E+00 | 4 | 2 | .2964E-01 | 224 | 0 | 16 | 30 | 9 | 15 |
| 71 | -.2172E-03 | 2 | 2 | .7550E-04 | -.1364E+00 | 4 | 2 | .2886E-01 | 224 | 0 | 16 | 30 | 9 | 15 |
| 72 | -.2125E-03 | 2 | 2 | .7392E-04 | -.1335E+00 | 4 | 2 | .2822E-01 | 224 | 0 | 16 | 30 | 9 | 15 |
| 73 | -.2079E-03 | 2 | 2 | .7207E-04 | -.1307E+00 | 4 | 2 | .2753E-01 | 224 | 0 | 16 | 30 | 9 | 16 |
| 74 | -.2034E-03 | 2 | 2 | .7035E-04 | -.1280E+00 | 4 | 2 | .2681E-01 | 224 | 0 | 16 | 30 | 10 | 12 |
| 75 | -.1990E-03 | 2 | 2 | .6890E-04 | -.1252E+00 | 4 | 2 | .2617E-01 | 224 | 0 | 16 | 30 | 10 | 12 |
| 76 | -.1946E-03 | 2 | 2 | .6732E-04 | -.1226E+00 | 4 | 2 | .2562E-01 | 223 | 0 | 16 | 30 | 10 | 12 |
| 77 | -.1904E-03 | 2 | 2 | .6579E-04 | -.1200E+00 | 4 | 2 | .2501E-01 | 223 | 0 | 16 | 30 | 10 | 12 |
| 78 | -.1862E-03 | 2 | 2 | .6423E-04 | -.1175E+00 | 4 | 2 | .2442E-01 | 223 | 0 | 16 | 30 | 10 | 12 |
| 79 | -.1822E-03 | 2 | 2 | .6265E-04 | -.1150E+00 | 4 | 2 | .2383E-01 | 223 | 0 | 16 | 30 | 10 | 12 |
| 80 | -.1782E-03 | 2 | 2 | .6105E-04 | -.1125E+00 | 4 | 2 | .2325E-01 | 223 | 0 | 16 | 30 | 10 | 13 |
| 81 | -.1744E-03 | 2 | 2 | .5964E-04 | -.1102E+00 | 4 | 2 | .2279E-01 | 222 | 0 | 16 | 30 | 10 | 13 |
| 82 | -.1706E-03 | 2 | 2 | .5818E-04 | -.1078E+00 | 4 | 2 | .2225E-01 | 222 | 0 | 16 | 30 | 10 | 13 |
| 83 | -.1669E-03 | 2 | 2 | .5671E-04 | -.1055E+00 | 4 | 2 | .2172E-01 | 222 | 0 | 16 | 30 | 10 | 13 |
| 84 | -.1632E-03 | 2 | 2 | .5522E-04 | -.1032E+00 | 4 | 2 | .2119E-01 | 222 | 0 | 16 | 30 | 10 | 13 |
| 85 | -.1596E-03 | 2 | 2 | .5373E-04 | -.1010E+00 | 4 | 2 | .2066E-01 | 222 | 0 | 16 | 30 | 10 | 13 |
| 86 | -.1561E-03 | 2 | 2 | .5223E-04 | -.9882E-01 | 4 | 2 | .2013E-01 | 222 | 0 | 16 | 30 | 10 | 13 |
| 87 | -.1527E-03 | 2 | 2 | .5076E-04 | -.9667E-01 | 4 | 2 | .1961E-01 | 222 | 0 | 16 | 30 | 10 | 13 |
| 88 | -.1493E-03 | 2 | 2 | .4930E-04 | -.9455E-01 | 4 | 2 | .1910E-01 | 222 | 0 | 16 | 30 | 10 | 13 |
| 89 | -.1460E-03 | 2 | 2 | .4803E-04 | -.9247E-01 | 4 | 2 | .1875E-01 | 221 | 0 | 16 | 30 | 10 | 13 |
| 90 | -.1427E-03 | 2 | 2 | .4675E-04 | -.9043E-01 | 4 | 2 | .1828E-01 | 221 | 0 | 16 | 30 | 10 | 13 |
| 91 | -.1395E-03 | 2 | 2 | .4547E-04 | -.8843E-01 | 4 | 2 | .1782E-01 | 222 | 0 | 16 | 30 | 10 | 13 |
| 92 | -.1364E-03 | 2 | 2 | .4416E-04 | -.8646E-01 | 4 | 2 | .1739E-01 | 223 | 0 | 16 | 30 | 10 | 13 |
| 93 | -.1333E-03 | 2 | 2 | .4291E-04 | -.8453E-01 | 4 | 2 | .1696E-01 | 223 | 0 | 16 | 30 | 10 | 13 |
| 94 | -.1303E-03 | 2 | 2 | .4169E-04 | -.8264E-01 | 4 | 2 | .1655E-01 | 223 | 0 | 16 | 30 | 10 | 13 |
| 95 | -.1273E-03 | 2 | 2 | .4041E-04 | -.8079E-01 | 4 | 2 | .1611E-01 | 222 | 0 | 16 | 30 | 10 | 13 |
| 96 | -.1244E-03 | 2 | 2 | .3923E-04 | -.7898E-01 | 4 | 2 | .1571E-01 | 222 | 0 | 16 | 30 | 10 | 13 |
| 97 | -.1216E-03 | 2 | 2 | .3799E-04 | -.7721E-01 | 4 | 2 | .1528E-01 | 221 | 0 | 16 | 30 | 10 | 13 |
| 98 | -.1188E-03 | 2 | 2 | .3687E-04 | -.7548E-01 | 4 | 2 | .1490E-01 | 221 | 0 | 16 | 30 | 10 | 13 |
| 99 | -.1161E-03 | 2 | 2 | .3578E-04 | -.7378E-01 | 4 | 2 | .1452E-01 | 221 | 0 | 16 | 30 | 10 | 13 |
| 100 | -.1135E-03 | 2 | 2 | .3505E-04 | -.7211E-01 | 4 | 2 | .1431E-01 | 220 | 0 | 16 | 30 | 10 | 13 |
| 101 | -.1109E-03 | 2 | 2 | .3415E-04 | -.7049E-01 | 4 | 2 | .1395E-01 | 220 | 0 | 16 | 30 | 10 | 13 |
| 102 | -.1084E-03 | 2 | 2 | .3326E-04 | -.6890E-01 | 4 | 2 | .1360E-01 | 220 | 0 | 16 | 30 | 10 | 13 |
| 103 | -.1059E-03 | 2 | 2 | .3237E-04 | -.6735E-01 | 4 | 2 | .1328E-01 | 220 | 0 | 16 | 30 | 10 | 14 |
| 104 | -.1035E-03 | 2 | 2 | .3189E-04 | -.6584E-01 | 4 | 2 | .1315E-01 | 218 | 0 | 16 | 30 | 10 | 14 |
| 105 | -.1012E-03 | 2 | 2 | .3117E-04 | -.6438E-01 | 4 | 2 | .1279E-01 | 218 | 0 | 16 | 30 | 10 | 14 |
| 106 | -.9893E-04 | 2 | 2 | .3043E-04 | -.6296E-01 | 4 | 2 | .1245E-01 | 218 | 0 | 16 | 30 | 10 | 14 |
| 107 | -.9673E-04 | 2 | 2 | .2968E-04 | -.6157E-01 | 4 | 2 | .1214E-01 | 218 | 0 | 16 | 30 | 10 | 14 |
| 108 | -.9458E-04 | 2 | 2 | .2893E-04 | -.6021E-01 | 4 | 2 | .1182E-01 | 218 | 0 | 16 | 30 | 10 | 14 |
| 109 | -.9249E-04 | 2 | 2 | .2819E-04 | -.5888E-01 | 4 | 2 | .1152E-01 | 218 | 0 | 16 | 30 | 10 | 14 |
| 110 | -.9044E-04 | 2 | 2 | .2752E-04 | -.5758E-01 | 4 | 2 | .1123E-01 | 217 | 0 | 16 | 30 | 10 | 14 |
| 111 | -.8844E-04 | 2 | 2 | .2683E-04 | -.5631E-01 | 4 | 2 | .1093E-01 | 217 | 0 | 16 | 30 | 10 | 14 |
| 112 | -.8649E-04 | 2 | 2 | .2616E-04 | -.5507E-01 | 4 | 2 | .1064E-01 | 217 | 0 | 16 | 30 | 10 | 14 |
| 113 | -.8457E-04 | 2 | 2 | .2550E-04 | -.5385E-01 | 4 | 2 | .1037E-01 | 217 | 0 | 16 | 30 | 10 | 14 |
| 114 | -.8269E-04 | 2 | 2 | .2486E-04 | -.5265E-01 | 4 | 2 | .1010E-01 | 217 | 0 | 16 | 30 | 10 | 14 |
| 115 | -.8084E-04 | 2 | 2 | .2438E-04 | -.5147E-01 | 4 | 2 | .9947E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 116 | -.7904E-04 | 2 | 2 | .2382E-04 | -.5032E-01 | 4 | 2 | .9679E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 117 | -.7726E-04 | 2 | 2 | .2327E-04 | -.4918E-01 | 4 | 2 | .9423E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 118 | -.7552E-04 | 2 | 2 | .2274E-04 | -.4807E-01 | 4 | 2 | .9186E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 119 | -.7381E-04 | 2 | 2 | .2222E-04 | -.4698E-01 | 4 | 2 | .8969E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 120 | -.7213E-04 | 2 | 2 | .2171E-04 | -.4590E-01 | 4 | 2 | .8763E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 121 | -.7048E-04 | 2 | 2 | .2122E-04 | -.4485E-01 | 4 | 2 | .8567E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 122 | -.6886E-04 | 2 | 2 | .2076E-04 | -.4381E-01 | 4 | 2 | .8382E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 123 | -.6727E-04 | 2 | 2 | .2032E-04 | -.4280E-01 | 4 | 2 | .8226E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 124 | -.6571E-04 | 2 | 2 | .1990E-04 | -.4180E-01 | 4 | 2 | .8085E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 125 | -.6418E-04 | 2 | 2 | .1949E-04 | -.4082E-01 | 4 | 2 | .7950E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 126 | -.6268E-04 | 2 | 2 | .1910E-04 | -.3986E-01 | 4 | 2 | .7828E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 127 | -.6121E-04 | 2 | 2 | .1872E-04 | -.3893E-01 | 4 | 2 | .7712E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 128 | -.5977E-04 | 2 | 2 | .1835E-04 | -.3800E-01 | 4 | 2 | .7603E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 129 | -.5835E-04 | 2 | 2 | .1799E-04 | -.3710E-01 | 4 | 2 | .7498E-02 | 216 | 0 | 16 | 30 | 10 | 14 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 130 | -.5696E-04 | 2 | 2 | .1764E-04 | -.3622E-01 | 4 | 2 | .7393E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 131 | -.5561E-04 | 2 | 2 | .1730E-04 | -.3536E-01 | 4 | 2 | .7289E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 132 | -.5428E-04 | 2 | 2 | .1696E-04 | -.3451E-01 | 4 | 2 | .7185E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 133 | -.5297E-04 | 2 | 2 | .1663E-04 | -.3368E-01 | 4 | 2 | .7082E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 134 | -.5170E-04 | 2 | 2 | .1631E-04 | -.3287E-01 | 4 | 2 | .6980E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 135 | -.5045E-04 | 2 | 2 | .1600E-04 | -.3208E-01 | 4 | 2 | .6879E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 136 | -.4923E-04 | 2 | 2 | .1569E-04 | -.3155E-01 | 17 | 3 | .6778E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 137 | -.4804E-04 | 2 | 2 | .1539E-04 | -.3193E-01 | 16 | 2 | .6680E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 138 | -.4688E-04 | 2 | 2 | .1510E-04 | -.3248E-01 | 16 | 2 | .6584E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 139 | -.4574E-04 | 2 | 2 | .1481E-04 | -.3293E-01 | 16 | 2 | .6489E-02 | 216 | 0 | 16 | 30 | 10 | 14 |
| 140 | -.8066E-04 | 11 | 11 | .1490E-04 | -.5556E-01 | 11 | 11 | .6569E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 141 | -.6072E-04 | 11 | 11 | .1471E-04 | -.4387E-01 | 11 | 11 | .6448E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 142 | -.4681E-04 | 11 | 11 | .1451E-04 | -.3583E-01 | 11 | 11 | .6332E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 143 | -.4146E-04 | 2 | 2 | .1428E-04 | -.3514E-01 | 16 | 2 | .6222E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 144 | -.4046E-04 | 2 | 2 | .1405E-04 | -.3545E-01 | 16 | 2 | .6118E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 145 | -.3949E-04 | 2 | 2 | .1382E-04 | -.3563E-01 | 16 | 2 | .6020E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 146 | -.3854E-04 | 2 | 2 | .1358E-04 | -.3570E-01 | 16 | 2 | .5928E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 147 | -.3762E-04 | 2 | 2 | .1334E-04 | -.3566E-01 | 16 | 2 | .5845E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 148 | -.3673E-04 | 2 | 2 | .1311E-04 | -.3552E-01 | 16 | 2 | .5762E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 149 | -.3587E-04 | 2 | 2 | .1288E-04 | -.3532E-01 | 16 | 2 | .5680E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 150 | -.3503E-04 | 2 | 2 | .1265E-04 | -.3505E-01 | 16 | 2 | .5598E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 151 | -.3422E-04 | 2 | 2 | .1243E-04 | -.3475E-01 | 16 | 2 | .5517E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 152 | -.3343E-04 | 2 | 2 | .1221E-04 | -.3441E-01 | 16 | 2 | .5437E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 153 | -.3267E-04 | 2 | 2 | .1199E-04 | -.3406E-01 | 16 | 2 | .5357E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 154 | -.3193E-04 | 2 | 2 | .1178E-04 | -.3370E-01 | 16 | 2 | .5279E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 155 | -.3121E-04 | 2 | 2 | .1157E-04 | -.3334E-01 | 16 | 2 | .5202E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 156 | -.3051E-04 | 2 | 2 | .1137E-04 | -.3299E-01 | 16 | 2 | .5126E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 157 | -.2982E-04 | 2 | 2 | .1117E-04 | -.3264E-01 | 16 | 2 | .5052E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 158 | -.2916E-04 | 2 | 2 | .1097E-04 | -.3230E-01 | 16 | 2 | .4979E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 159 | -.2851E-04 | 2 | 2 | .1078E-04 | -.3197E-01 | 16 | 2 | .4907E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 160 | -.2788E-04 | 2 | 2 | .1059E-04 | -.3164E-01 | 16 | 2 | .4838E-02 | 215 | 0 | 16 | 30 | 10 | 14 |
| 161 | -.2726E-04 | 2 | 2 | .1040E-04 | -.3132E-01 | 16 | 2 | .4769E-02 | 215 | 0 | 16 | 30 | 10 | 15 |
| 162 | -.7661E-04 | 14 | 10 | .1079E-04 | -.3158E-01 | 16 | 2 | .4806E-02 | 214 | 0 | 16 | 30 | 10 | 15 |
| 163 | -.4362E-04 | 14 | 10 | .1063E-04 | -.3213E-01 | 16 | 2 | .4716E-02 | 214 | 0 | 16 | 30 | 10 | 15 |
| 164 | -.2780E-04 | 14 | 10 | .1045E-04 | -.3254E-01 | 16 | 2 | .4636E-02 | 214 | 0 | 16 | 30 | 10 | 15 |
| 165 | -.2494E-04 | 2 | 2 | .1026E-04 | -.3275E-01 | 16 | 2 | .4567E-02 | 214 | 0 | 16 | 30 | 10 | 15 |
| 166 | -.2440E-04 | 2 | 2 | .1007E-04 | -.3276E-01 | 16 | 2 | .4504E-02 | 214 | 0 | 16 | 30 | 10 | 15 |
| 167 | -.2386E-04 | 2 | 2 | .9889E-05 | -.3259E-01 | 16 | 2 | .4442E-02 | 214 | 0 | 16 | 30 | 10 | 15 |
| 168 | -.2334E-04 | 2 | 2 | .9710E-05 | -.3227E-01 | 16 | 2 | .4380E-02 | 214 | 0 | 16 | 30 | 10 | 15 |
| 169 | -.2284E-04 | 2 | 2 | .9536E-05 | .3235E-01 | 9 | 11 | .4319E-02 | 214 | 0 | 16 | 30 | 10 | 15 |
| 170 | -.2234E-04 | 2 | 2 | .9366E-05 | .3264E-01 | 9 | 11 | .4259E-02 | 214 | 0 | 16 | 30 | 10 | 15 |
| 171 | -.2186E-04 | 2 | 2 | .9201E-05 | .3292E-01 | 9 | 11 | .4200E-02 | 214 | 0 | 16 | 30 | 10 | 15 |
| 172 | -.5914E-04 | 17 | 10 | .9290E-05 | -.3832E-01 | 17 | 10 | .4227E-02 | 213 | 0 | 16 | 30 | 10 | 15 |
| 173 | -.4771E-04 | 17 | 10 | .9195E-05 | .3349E-01 | 9 | 11 | .4150E-02 | 213 | 0 | 16 | 30 | 10 | 15 |
| 174 | -.3894E-04 | 17 | 10 | .9079E-05 | .3377E-01 | 9 | 11 | .4077E-02 | 213 | 0 | 16 | 30 | 10 | 15 |
| 175 | -.3214E-04 | 17 | 10 | .8951E-05 | .3406E-01 | 9 | 11 | .4007E-02 | 213 | 0 | 16 | 30 | 10 | 15 |
| 176 | -.2684E-04 | 17 | 10 | .8817E-05 | .3433E-01 | 9 | 11 | .3944E-02 | 213 | 0 | 16 | 30 | 10 | 15 |
| 177 | -.2267E-04 | 17 | 10 | .8680E-05 | .3461E-01 | 9 | 11 | .3887E-02 | 213 | 0 | 16 | 30 | 10 | 15 |
| 178 | .9228E-04 | 4 | 13 | .8712E-05 | .3488E-01 | 9 | 11 | .3809E-02 | 213 | 0 | 16 | 30 | 10 | 15 |
| 179 | -.1978E-04 | 2 | 12 | .8618E-05 | .3514E-01 | 9 | 11 | .3823E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 180 | .9393E-04 | 4 | 13 | .8468E-05 | .3540E-01 | 9 | 11 | .3715E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 181 | .3278E-04 | 4 | 13 | .8051E-05 | .3565E-01 | 9 | 11 | .3679E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 182 | -.1721E-04 | 2 | 2 | .7852E-05 | .3590E-01 | 9 | 11 | .3644E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 183 | -.1681E-04 | 2 | 2 | .7715E-05 | .3614E-01 | 9 | 11 | .3606E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 184 | -.1641E-04 | 2 | 2 | .7604E-05 | .3637E-01 | 9 | 11 | .3569E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 185 | -.1603E-04 | 2 | 2 | .7497E-05 | .3660E-01 | 9 | 11 | .3531E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 186 | -.1567E-04 | 2 | 2 | .7390E-05 | .3682E-01 | 9 | 11 | .3492E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 187 | -.1532E-04 | 2 | 2 | .7282E-05 | .3703E-01 | 9 | 11 | .3453E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 188 | -.1500E-04 | 2 | 2 | .7174E-05 | .3724E-01 | 9 | 11 | .3414E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 189 | -.1469E-04 | 2 | 2 | .7066E-05 | .3744E-01 | 9 | 11 | .3376E-02 | 212 | 0 | 16 | 30 | 10 | 15 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 190 | -.1439E-04 | 2 | 2 | .6958E-05 | .3763E-01 | 9 | 11 | .3337E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 191 | -.1411E-04 | 2 | 2 | .6851E-05 | .3782E-01 | 9 | 11 | .3299E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 192 | -.1383E-04 | 2 | 2 | .6744E-05 | .3800E-01 | 9 | 11 | .3261E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 193 | -.1357E-04 | 2 | 2 | .6639E-05 | .3818E-01 | 9 | 11 | .3223E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 194 | -.1332E-04 | 2 | 2 | .6535E-05 | .3835E-01 | 9 | 11 | .3185E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 195 | -.1307E-04 | 2 | 2 | .6432E-05 | .3853E-01 | 9 | 11 | .3148E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 196 | -.1283E-04 | 2 | 2 | .6329E-05 | .3869E-01 | 9 | 11 | .3111E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 197 | -.1260E-04 | 2 | 2 | .6228E-05 | .3886E-01 | 9 | 11 | .3075E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 198 | -.1237E-04 | 2 | 2 | .6129E-05 | .3902E-01 | 9 | 11 | .3039E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 199 | -.1215E-04 | 2 | 2 | .6030E-05 | .3918E-01 | 9 | 11 | .3003E-02 | 212 | 0 | 16 | 30 | 10 | 15 |
| 200 | -.1193E-04 | 2 | 2 | .5933E-05 | .3933E-01 | 9 | 11 | .2969E-02 | 212 | 0 | 16 | 30 | 10 | 15 |

REMAP USING INITIAL COMPUTED SHOCK LOCATION




REMAP USING COMPUTATIONAL SHOCK SHAPE: JSHMAX AND JSHMIN SHOULD EVEN UP AND MOVE OUT

MAPPING METRIC AND FREESTREAM VELOCITIES AT GRID POINTS

| I | J | RHO | THE | PSI | OMEG | H | UI | VI | WI |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 | .33265E+00 | -.15708E+01 | .14155E-01 | -.15708E+01 | .18209E+01 | .12312E-14 | -.22174E+00 | .97511E+00 |
| 3 | 2 | .32632E+00 | -.14586E+01 | .67881E-01 | -.39586E-01 | .18428E+01 | -.67280E-01 | -.21022E+00 | .97534E+00 |
| 4 | 2 | .31934E+00 | -.13464E+01 | .13508E+00 | .71027E-01 | .18407E+01 | -.13445E+00 | -.19659E+00 | .97122E+00 |
| 5 | 2 | .31311E+00 | -.12342E+01 | .20070E+00 | .97679E-01 | .18059E+01 | -.19996E+00 | -.18304E+00 | .96256E+00 |
| 6 | 2 | .30958E+00 | -.11220E+01 | .26277E+00 | .89595E-01 | .17269E+01 | -.26184E+00 | -.17342E+00 | .94940E+00 |
| 7 | 2 | .30876E+00 | -.10098E+01 | .32034E+00 | .68000E-01 | .16068E+01 | -.31854E+00 | -.16837E+00 | .93283E+00 |
| 8 | 2 | .30992E+00 | -.89760E+00 | .37295E+00 | .44056E-01 | .14559E+01 | -.36915E+00 | -.16700E+00 | .91424E+00 |
| 9 | 2 | .31236E+00 | -.78540E+00 | .42019E+00 | .22401E-01 | .12840E+01 | -.41308E+00 | -.16856E+00 | .89496E+00 |
| 10 | 2 | .31513E+00 | -.67320E+00 | .46172E+00 | .58178E-02 | .11011E+01 | -.45034E+00 | -.17135E+00 | .87626E+00 |
| 11 | 2 | .31765E+00 | -.56100E+00 | .49717E+00 | -.56375E-02 | .91293E+00 | -.48114E+00 | -.17418E+00 | .85917E+00 |
| 12 | 2 | .32005E+00 | -.44880E+00 | .52622E+00 | -.13566E-01 | .72156E+00 | -.50529E+00 | -.17797E+00 | .84440E+00 |
| 13 | 2 | .32357E+00 | -.33660E+00 | .54862E+00 | -.19970E-01 | .52693E+00 | -.52023E+00 | -.19083E+00 | .83244E+00 |
| 14 | 2 | .32948E+00 | -.22440E+00 | .56433E+00 | -.24708E-01 | .33308E+00 | -.51507E+00 | -.23699E+00 | .82373E+00 |
| 15 | 2 | .33743E+00 | -.11220E+00 | .57352E+00 | -.25427E-01 | .15624E+00 | -.41163E+00 | -.40022E+00 | .81877E+00 |
| 16 | 2 | .34375E+00 | -.71054E-14 | .57604E+00 | -.20627E-01 | .99749E-01 | .38659E+00 | -.42600E+00 | .81796E+00 |
| 17 | 2 | .34902E+00 | .11220E+00 | .57183E+00 | -.11807E-01 | .24009E+00 | .56409E+00 | -.86176E-01 | .82121E+00 |
| 18 | 2 | .35064E+00 | .22440E+00 | .56056E+00 | -.16665E-02 | .39910E+00 | .55990E+00 | .22197E-01 | .82827E+00 |
| 19 | 2 | .35191E+00 | .33660E+00 | .54267E+00 | .99505E-02 | .55922E+00 | .54027E+00 | .68589E-01 | .83869E+00 |
| 20 | 2 | .35268E+00 | .44880E+00 | .51831E+00 | .22866E-01 | .71587E+00 | .51478E+00 | .95098E-01 | .85203E+00 |
| 21 | 2 | .35410E+00 | .56100E+00 | .48790E+00 | .39078E-01 | .86535E+00 | .48461E+00 | .10970E+00 | .86782E+00 |
| 22 | 2 | .35629E+00 | .67320E+00 | .45182E+00 | .60445E-01 | .10045E+01 | .44955E+00 | .11763E+00 | .88548E+00 |
| 23 | 2 | .35882E+00 | .78540E+00 | .41045E+00 | .88278E-01 | .11315E+01 | .40918E+00 | .12232E+00 | .90422E+00 |
| 24 | 2 | .36083E+00 | .89760E+00 | .36411E+00 | .12263E+00 | .12469E+01 | .36323E+00 | .12646E+00 | .92308E+00 |
| 25 | 2 | .36125E+00 | .10098E+01 | .31305E+00 | .16203E+00 | .13524E+01 | .31174E+00 | .13211E+00 | .94094E+00 |
| 26 | 2 | .35931E+00 | .11220E+01 | .25755E+00 | .20450E+00 | .14501E+01 | .25520E+00 | .14041E+00 | .95664E+00 |
| 27 | 2 | .35417E+00 | .12342E+01 | .19780E+00 | .24506E+00 | .15431E+01 | .19437E+00 | .15259E+00 | .96899E+00 |
| 28 | 2 | .34648E+00 | .13464E+01 | .13455E+00 | .28569E+00 | .16297E+01 | .13056E+00 | .16763E+00 | .97717E+00 |
| 29 | 2 | .33853E+00 | .14586E+01 | .69789E-01 | .37816E+00 | .16995E+01 | .65345E-01 | .18203E+00 | .98112E+00 |
| 30 | 2 | .33162E+00 | .15708E+01 | .14155E-01 | .15708E+01 | .17444E+01 | .11382E-13 | .19485E+00 | .98099E+00 |

SURFACE ARC LENGTH (S) SLOPE (THETA) AND CURVATURE (PSI)

| I | X/Z | Y/Z | S | THETA | PSI | (X/Z)/XMAX | (Y/Z)/XMAX | DYBP/DZP |
|---|---|---|---|---|---|---|---|---|
| 1 | -.00000 | -.01416 | 0.00000 | 9.19264 | .31414 | -.00000 | -.02180 | -.22360 |
| 2 | .06793 | -.00269 | .06889 | 9.95043 | .03245 | .10461 | -.00414 | -.22405 |
| 3 | .13556 | .00964 | .13764 | 9.45096 | -.46571 | .20876 | .01485 | -.22236 |
| 4 | .20247 | .01984 | .20533 | 5.60673 | -1.08595 | .31179 | .03055 | -.20948 |
| 5 | .26791 | .02407 | .27093 | 1.10677 | -1.11797 | .41257 | .03706 | -.19055 |
| 6 | .33100 | .02254 | .33406 | -2.73573 | -1.02233 | .50972 | .03471 | -.17108 |
| 7 | .39088 | .01723 | .39418 | -6.13507 | -.71223 | .60192 | .02654 | -.15019 |
| 8 | .44668 | .01001 | .45045 | -7.67253 | -.15398 | .68786 | .01541 | -.13926 |
| 9 | .49758 | .00289 | .50184 | -7.72597 | .06862 | .76623 | .00446 | -.13904 |
| 10 | .54263 | -.00306 | .54728 | -7.34760 | -.01984 | .83561 | -.00471 | -.14253 |
| 11 | .58080 | -.00788 | .58575 | -7.69958 | -.30916 | .89438 | -.01213 | -.13880 |
| 12 | .61108 | -.01221 | .61634 | -8.61171 | .73202 | .94102 | -.01879 | -.12910 |
| 13 | .63281 | -.01564 | .63835 | -5.02490 | 8.90770 | .97448 | -.02408 | -.16944 |
| 14 | .64574 | -.01642 | .65166 | 28.32868 | 77.08674 | .99439 | -.02529 | -.57398 |
| 15 | .64938 | -.01340 | .65653 | 64.90918 | 136.75686 | 1.00000 | -.02063 | -1.60970 |
| 16 | .64351 | -.00760 | .66581 | 144.55220 | 39.59667 | .99096 | -.01170 | .24109 |
| 17 | .62773 | -.00105 | .68300 | 160.42027 | 6.38028 | .96665 | -.00161 | .01279 |
| 18 | .60303 | .00600 | .70869 | 165.88655 | 1.95459 | .92862 | .00924 | -.05182 |
| 19 | .57017 | .01304 | .74231 | 168.45740 | .62664 | .87801 | .02008 | -.07996 |
| 20 | .53029 | .02073 | .78292 | 169.23119 | .23402 | .81660 | .03193 | -.08785 |
| 21 | .48442 | .02932 | .82959 | 169.65527 | .23377 | .74597 | .04514 | -.09170 |
| 22 | .43347 | .03837 | .88133 | 170.72479 | .52468 | .66751 | .05908 | -.10028 |
| 23 | .37824 | .04662 | .93718 | 173.18175 | .93847 | .58246 | .07179 | -.11760 |
| 24 | .31946 | .05222 | .99624 | 177.31196 | 1.21130 | .49194 | .08041 | -.14222 |
| 25 | .25792 | .05349 | 1.05782 | 181.55226 | 1.24687 | .39717 | .08237 | -.16294 |
| 26 | .19443 | .04862 | 1.12151 | 186.30045 | 1.11588 | .29940 | .07488 | -.18228 |
| 27 | .12988 | .03815 | 1.18691 | 189.95137 | .46051 | .20001 | .05875 | -.19408 |
| 28 | .06496 | .02581 | 1.25299 | 190.46088 | -.01128 | .10004 | .03974 | -.19562 |
| 29 | .00000 | .01416 | 1.31900 | 189.86743 | -.26637 | .00000 | .02180 | -.19528 |
| I | X/Z | Y/Z | S | THETA | PSI | (X/Z)/XMAX | (Y/Z)/XMAX | DYBP/DZP |

SMAX= 1.31900 XMAX= .64938 SMAX/XMAX= 2.03115

NEW SHOCK LOCATION

| I | C(I) | CPR(I) | CSEC(I) |
|---|---|---|---|
| 2 | .951288E+00 | 0. | -.162392E+00 |
| 3 | .950266E+00 | -.190599E-01 | -.177358E+00 |
| 4 | .947011E+00 | -.409115E-01 | -.212154E+00 |
| 5 | .941086E+00 | -.664552E-01 | -.243171E+00 |
| 6 | .932099E+00 | -.939573E-01 | -.247063E+00 |
| 7 | .920002E+00 | -.119642E+00 | -.210779E+00 |
| 8 | .905251E+00 | -.138976E+00 | -.133846E+00 |
| 9 | .888816E+00 | -.147887E+00 | -.250103E-01 |
| 10 | .872065E+00 | -.143427E+00 | .104516E+00 |
| 11 | .856631E+00 | -.123665E+00 | .247744E+00 |
| 12 | .844315E+00 | -.872152E-01 | .401991E+00 |
| 13 | .837060E+00 | -.332324E-01 | .560273E+00 |
| 14 | .836858E+00 | .376545E-01 | .703310E+00 |
| 15 | .845509E+00 | .122188E+00 | .803538E+00 |
| 16 | .864277E+00 | .214329E+00 | .838907E+00 |
| 17 | .893605E+00 | .306454E+00 | .803242E+00 |
| 18 | .933045E+00 | .391133E+00 | .706203E+00 |
| 19 | .981375E+00 | .462571E+00 | .567191E+00 |
| 20 | .103685E+01 | .517278E+00 | .407984E+00 |
| 21 | .109745E+01 | .553908E+00 | .244960E+00 |
| 22 | .116114E+01 | .572336E+00 | .835249E-01 |
| 23 | .122588E+01 | .572483E+00 | -.809024E-01 |
| 24 | .128961E+01 | .553579E+00 | -.256075E+00 |
| 25 | .135011E+01 | .514174E+00 | -.446333E+00 |
| 26 | .140499E+01 | .452672E+00 | -.649952E+00 |
| 27 | .145169E+01 | .368106E+00 | -.857468E+00 |
| 28 | .148759E+01 | .261235E+00 | -.104754E+01 |
| 29 | .151031E+01 | .135938E+00 | -.118593E+01 |
| 30 | .151809E+01 | 0. | -.123721E+01 |
| I | C(I) | CPR(I) | CSEC(I) |

| ITER | DELMX | I | J | DELAVG | RESMX | I | J | RESAVG | KSUP | NPVD | JSHMAX | ISHMAX | JSHMIN | ISHMIN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 201 | -.9215E-03 | 17 | 2 | .4208E-04 | -.2965E+01 | 16 | 3 | .9079E-01 | 292 | 0 | 21 | 2 | 20 | 10 |
| 202 | -.8137E-03 | 17 | 2 | .2161E-04 | -.1499E+01 | 16 | 3 | .2697E-01 | 148 | 0 | 21 | 2 | 20 | 10 |
| 203 | -.6480E-03 | 16 | 2 | .1874E-04 | -.1552E+01 | 16 | 2 | .2026E-01 | 148 | 0 | 21 | 2 | 20 | 9 |
| 204 | -.5028E-03 | 16 | 2 | .1683E-04 | -.1098E+01 | 16 | 2 | .1694E-01 | 149 | 0 | 21 | 2 | 20 | 9 |
| 205 | -.3735E-03 | 16 | 2 | .1539E-04 | -.7551E+00 | 17 | 3 | .1508E-01 | 148 | 0 | 21 | 2 | 20 | 9 |
| 206 | -.3555E-03 | 17 | 2 | .1493E-04 | -.6931E+00 | 17 | 3 | .1441E-01 | 147 | 0 | 21 | 2 | 20 | 9 |
| 207 | -.3101E-03 | 17 | 2 | .1401E-04 | -.5516E+00 | 17 | 3 | .1371E-01 | 147 | 0 | 21 | 2 | 20 | 9 |
| 208 | -.2402E-03 | 17 | 2 | .1302E-04 | -.4147E+00 | 17 | 3 | .1300E-01 | 147 | 0 | 21 | 2 | 20 | 9 |
| 209 | -.1957E-03 | 18 | 3 | .1222E-04 | -.3259E+00 | 18 | 3 | .1229E-01 | 147 | 0 | 21 | 2 | 20 | 9 |
| 210 | -.1778E-03 | 18 | 3 | .1166E-04 | -.2908E+00 | 18 | 3 | .1180E-01 | 147 | 0 | 21 | 2 | 20 | 9 |
| 211 | -.1614E-03 | 18 | 3 | .1125E-04 | -.2581E+00 | 18 | 3 | .1150E-01 | 147 | 0 | 21 | 2 | 20 | 9 |
| 212 | -.1491E-03 | 18 | 2 | .1091E-04 | -.2285E+00 | 18 | 3 | .1127E-01 | 147 | 0 | 21 | 2 | 20 | 9 |
| 213 | -.1371E-03 | 19 | 2 | .1064E-04 | -.2020E+00 | 18 | 3 | .1109E-01 | 147 | 0 | 21 | 2 | 20 | 9 |
| 214 | -.1346E-03 | 19 | 2 | .1044E-04 | -.1787E+00 | 18 | 3 | .1092E-01 | 146 | 0 | 21 | 2 | 20 | 9 |
| 215 | -.1301E-03 | 19 | 2 | .1029E-04 | -.1603E+00 | 19 | 3 | .1080E-01 | 146 | 0 | 21 | 2 | 20 | 9 |
| 216 | -.1245E-03 | 19 | 2 | .1014E-04 | -.1527E+00 | 19 | 3 | .1070E-01 | 146 | 0 | 21 | 2 | 20 | 9 |
| 217 | -.1182E-03 | 19 | 2 | .1001E-04 | -.1441E+00 | 19 | 3 | .1060E-01 | 146 | 0 | 21 | 2 | 20 | 10 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 218 | -.1118E-03 | 19 | 2 | .9997E-05 | -.1353E+00 | 19 | 3 | .1053E-01 | 145 | 0 | 21 | 2 | 20 | 10 |
| 219 | -.1054E-03 | 19 | 2 | .9932E-05 | -.1266E+00 | 19 | 3 | .1043E-01 | 145 | 0 | 21 | 2 | 20 | 10 |
| 220 | -.1042E-03 | 20 | 2 | .9906E-05 | -.1182E+00 | 19 | 3 | .1035E-01 | 145 | 0 | 21 | 2 | 20 | 10 |
| 221 | -.1022E-03 | 20 | 2 | .9893E-05 | -.1117E+00 | 20 | 4 | .1028E-01 | 145 | 0 | 21 | 2 | 20 | 10 |
| 222 | -.9961E-04 | 20 | 2 | .9864E-05 | -.1084E+00 | 20 | 4 | .1020E-01 | 144 | 0 | 21 | 2 | 20 | 10 |
| 223 | -.9662E-04 | 20 | 2 | .9858E-05 | -.1047E+00 | 20 | 4 | .1012E-01 | 144 | 0 | 21 | 2 | 20 | 10 |
| 224 | -.9335E-04 | 20 | 2 | .9848E-05 | -.1008E+00 | 20 | 4 | .1004E-01 | 144 | 0 | 21 | 2 | 20 | 10 |
| 225 | -.8993E-04 | 20 | 2 | .9836E-05 | -.9670E-01 | 20 | 4 | .9959E-02 | 144 | 0 | 21 | 2 | 20 | 10 |
| 226 | -.8645E-04 | 20 | 2 | .9821E-05 | -.9264E-01 | 20 | 4 | .9874E-02 | 144 | 0 | 21 | 2 | 20 | 10 |
| 227 | -.8297E-04 | 20 | 2 | .9808E-05 | -.8863E-01 | 20 | 4 | .9796E-02 | 144 | 0 | 21 | 2 | 20 | 10 |
| 228 | -.8052E-04 | 21 | 2 | .9795E-05 | -.8473E-01 | 20 | 4 | .9714E-02 | 144 | 0 | 21 | 2 | 20 | 10 |
| 229 | -.7934E-04 | 21 | 2 | .9776E-05 | -.8096E-01 | 20 | 4 | .9630E-02 | 144 | 0 | 21 | 2 | 20 | 10 |
| 230 | -.7788E-04 | 21 | 2 | .9751E-05 | -.7733E-01 | 20 | 4 | .9544E-02 | 144 | 0 | 21 | 2 | 20 | 10 |
| 231 | -.7621E-04 | 21 | 2 | .9722E-05 | -.7387E-01 | 20 | 4 | .9456E-02 | 144 | 0 | 21 | 2 | 20 | 10 |
| 232 | -.7438E-04 | 21 | 2 | .9689E-05 | -.7057E-01 | 20 | 4 | .9370E-02 | 144 | 0 | 21 | 2 | 20 | 10 |
| 233 | -.7244E-04 | 21 | 2 | .9652E-05 | -.6744E-01 | 20 | 4 | .9284E-02 | 144 | 0 | 21 | 2 | 20 | 10 |
| 234 | -.7043E-04 | 21 | 2 | .9612E-05 | -.6447E-01 | 20 | 4 | .9197E-02 | 144 | 0 | 21 | 2 | 20 | 10 |
| 235 | -.6838E-04 | 21 | 2 | .9569E-05 | -.6166E-01 | 20 | 4 | .9109E-02 | 144 | 0 | 21 | 2 | 20 | 10 |
| 236 | -.6610E-04 | 21 | 2 | .9503E-05 | -.5911E-01 | 21 | 4 | .9017E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 237 | -.6405E-04 | 21 | 2 | .9452E-05 | -.5719E-01 | 21 | 4 | .8923E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 238 | -.6198E-04 | 21 | 2 | .9400E-05 | -.5529E-01 | 21 | 4 | .8831E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 239 | -.5992E-04 | 21 | 2 | .9346E-05 | -.5342E-01 | 21 | 4 | .8739E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 240 | -.5790E-04 | 21 | 2 | .9292E-05 | -.5158E-01 | 21 | 4 | .8647E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 241 | -.5594E-04 | 21 | 2 | .9237E-05 | -.4977E-01 | 21 | 4 | .8558E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 242 | -.5443E-04 | 22 | 2 | .9182E-05 | -.4799E-01 | 21 | 4 | .8470E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 243 | -.5342E-04 | 22 | 2 | .9127E-05 | -.4627E-01 | 21 | 4 | .8384E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 244 | -.5234E-04 | 22 | 2 | .9071E-05 | -.4459E-01 | 21 | 4 | .8299E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 245 | -.5121E-04 | 22 | 2 | .9015E-05 | -.4296E-01 | 21 | 4 | .8217E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 246 | -.5004E-04 | 22 | 2 | .8958E-05 | -.4139E-01 | 21 | 4 | .8137E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 247 | -.4885E-04 | 22 | 2 | .8902E-05 | -.3994E-01 | 21 | 5 | .8057E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 248 | -.4763E-04 | 22 | 2 | .8844E-05 | -.3859E-01 | 21 | 5 | .7978E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 249 | -.4640E-04 | 22 | 2 | .8787E-05 | -.3730E-01 | 21 | 5 | .7900E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 250 | -.4517E-04 | 22 | 2 | .8729E-05 | -.3606E-01 | 21 | 5 | .7823E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 251 | -.4395E-04 | 22 | 2 | .8670E-05 | -.3487E-01 | 21 | 5 | .7748E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 252 | -.4274E-04 | 22 | 2 | .8611E-05 | -.3373E-01 | 21 | 5 | .7675E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 253 | -.4155E-04 | 22 | 2 | .8552E-05 | -.3265E-01 | 21 | 5 | .7603E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 254 | -.4038E-04 | 22 | 2 | .8493E-05 | -.3160E-01 | 21 | 5 | .7532E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 255 | -.3923E-04 | 22 | 2 | .8433E-05 | -.3061E-01 | 21 | 5 | .7462E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
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| 257 | -.3703E-04 | 22 | 2 | .8312E-05 | -.2875E-01 | 21 | 5 | .7325E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 258 | -.3597E-04 | 22 | 2 | .8252E-05 | -.2788E-01 | 21 | 5 | .7257E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 259 | -.3494E-04 | 22 | 2 | .8191E-05 | -.2704E-01 | 21 | 5 | .7190E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 260 | -.3394E-04 | 22 | 2 | .8130E-05 | .2658E-01 | 20 | 19 | .7124E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 261 | -.3298E-04 | 22 | 2 | .8068E-05 | .2657E-01 | 20 | 19 | .7058E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 262 | -.3204E-04 | 22 | 2 | .8007E-05 | .2656E-01 | 20 | 19 | .6994E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 263 | -.3114E-04 | 22 | 2 | .7945E-05 | .2656E-01 | 20 | 19 | .6930E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 264 | -.3027E-04 | 22 | 2 | .7883E-05 | .2655E-01 | 20 | 19 | .6866E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 265 | -.2942E-04 | 22 | 2 | .7821E-05 | .2654E-01 | 20 | 19 | .6804E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 266 | -.2860E-04 | 22 | 2 | .7759E-05 | .2654E-01 | 20 | 19 | .6742E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 267 | -.2782E-04 | 22 | 2 | .7697E-05 | .2653E-01 | 20 | 19 | .6681E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 268 | -.2706E-04 | 22 | 2 | .7635E-05 | .2653E-01 | 20 | 19 | .6620E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 269 | -.2632E-04 | 22 | 2 | .7572E-05 | .2652E-01 | 20 | 19 | .6561E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 270 | -.2561E-04 | 22 | 2 | .7510E-05 | .2652E-01 | 20 | 19 | .6501E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 271 | -.2493E-04 | 22 | 2 | .7448E-05 | .2652E-01 | 20 | 19 | .6443E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 272 | -.2427E-04 | 22 | 2 | .7385E-05 | .2652E-01 | 20 | 19 | .6385E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 273 | -.2363E-04 | 22 | 2 | .7323E-05 | .2652E-01 | 20 | 19 | .6327E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 274 | -.2301E-04 | 22 | 2 | .7261E-05 | .2652E-01 | 20 | 19 | .6271E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 275 | -.2242E-04 | 22 | 2 | .7199E-05 | .2653E-01 | 20 | 19 | .6214E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 276 | -.2185E-04 | 22 | 2 | .7136E-05 | .2653E-01 | 20 | 19 | .6159E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 277 | -.2129E-04 | 22 | 2 | .7074E-05 | .2654E-01 | 20 | 19 | .6104E-02 | 143 | 0 | 21 | 2 | 20 | 10 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 278 | -.2076E-04 | 22 | 2 | .7012E-05 | .2655E-01 | 20 | 19 | .6049E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 279 | -.2024E-04 | 22 | 2 | .6950E-05 | .2656E-01 | 20 | 19 | .5995E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 280 | -.1974E-04 | 22 | 2 | .6889E-05 | .2658E-01 | 20 | 19 | .5942E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 281 | -.1926E-04 | 22 | 2 | .6827E-05 | .2659E-01 | 20 | 19 | .5889E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 282 | -.1879E-04 | 22 | 2 | .6766E-05 | .2661E-01 | 20 | 19 | .5837E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 283 | -.1834E-04 | 22 | 2 | .6705E-05 | .2663E-01 | 20 | 19 | .5785E-02 | 143 | 0 | 21 | 2 | 20 | 10 |
| 284 | -.1791E-04 | 22 | 2 | .6644E-05 | .2665E-01 | 20 | 19 | .5734E-02 | 143 | 0 | 21 | 2 | 20 | 11 |
| 285 | -.4068E-04 | 10 | 20 | .6732E-05 | .2667E-01 | 20 | 19 | .5733E-02 | 143 | 0 | 21 | 2 | 20 | 11 |
| 286 | -.3077E-04 | 10 | 20 | .6712E-05 | .2669E-01 | 20 | 19 | .5695E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 287 | -.2605E-04 | 10 | 20 | .6688E-05 | .2671E-01 | 20 | 19 | .5661E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 288 | -.2386E-04 | 10 | 20 | .6661E-05 | .2674E-01 | 20 | 19 | .5636E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 289 | -.2295E-04 | 10 | 20 | .6633E-05 | .2677E-01 | 20 | 19 | .5609E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 290 | -.2263E-04 | 10 | 20 | .6602E-05 | .2680E-01 | 20 | 19 | .5581E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 291 | -.2252E-04 | 10 | 20 | .6570E-05 | .2683E-01 | 20 | 19 | .5553E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 292 | -.2239E-04 | 10 | 20 | .6535E-05 | .2686E-01 | 20 | 19 | .5523E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 293 | -.2214E-04 | 10 | 20 | .6497E-05 | .2689E-01 | 20 | 19 | .5492E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 294 | -.2172E-04 | 10 | 20 | .6456E-05 | .2693E-01 | 20 | 19 | .5460E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 295 | -.2111E-04 | 10 | 20 | .6411E-05 | .2696E-01 | 20 | 19 | .5427E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 296 | -.2034E-04 | 10 | 20 | .6364E-05 | .2700E-01 | 20 | 19 | .5392E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 297 | -.1944E-04 | 10 | 20 | .6313E-05 | .2704E-01 | 20 | 19 | .5356E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 298 | -.1842E-04 | 10 | 20 | .6260E-05 | .2707E-01 | 20 | 19 | .5318E-02 | 142 | 0 | 21 | 2 | 20 | 11 |
| 299 | -.1735E-04 | 10 | 20 | .6197E-05 | .2711E-01 | 20 | 19 | .5279E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 300 | -.1624E-04 | 10 | 20 | .6139E-05 | .2715E-01 | 20 | 19 | .5243E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 301 | -.1512E-04 | 10 | 20 | .6081E-05 | .2719E-01 | 20 | 19 | .5206E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 302 | -.1403E-04 | 10 | 20 | .6022E-05 | .2724E-01 | 20 | 19 | .5168E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 303 | -.1298E-04 | 10 | 20 | .5962E-05 | .2728E-01 | 20 | 19 | .5130E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 304 | -.1198E-04 | 10 | 20 | .5901E-05 | .2732E-01 | 20 | 19 | .5091E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 305 | -.1135E-04 | 22 | 2 | .5841E-05 | .2736E-01 | 20 | 19 | .5052E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 306 | -.1113E-04 | 22 | 2 | .5781E-05 | .2741E-01 | 20 | 19 | .5012E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 307 | -.1092E-04 | 22 | 2 | .5722E-05 | .2745E-01 | 20 | 19 | .4973E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 308 | -.1071E-04 | 22 | 2 | .5663E-05 | .2750E-01 | 20 | 19 | .4933E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 309 | -.1050E-04 | 22 | 2 | .5604E-05 | .2754E-01 | 20 | 19 | .4894E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 310 | -.1031E-04 | 22 | 2 | .5546E-05 | .2759E-01 | 20 | 19 | .4854E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 311 | -.1011E-04 | 22 | 2 | .5489E-05 | .2763E-01 | 20 | 19 | .4815E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 312 | -.9927E-05 | 22 | 2 | .5433E-05 | .2768E-01 | 20 | 19 | .4776E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 313 | -.9745E-05 | 22 | 2 | .5378E-05 | .2772E-01 | 20 | 19 | .4738E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 314 | -.9568E-05 | 22 | 2 | .5323E-05 | .2777E-01 | 20 | 19 | .4699E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 315 | -.9396E-05 | 22 | 2 | .5269E-05 | .2782E-01 | 20 | 19 | .4661E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 316 | -.9228E-05 | 22 | 2 | .5215E-05 | .2786E-01 | 20 | 19 | .4623E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 317 | -.9064E-05 | 22 | 2 | .5163E-05 | .2791E-01 | 20 | 19 | .4585E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 318 | -.8904E-05 | 22 | 2 | .5111E-05 | .2796E-01 | 20 | 19 | .4548E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 319 | -.8749E-05 | 22 | 2 | .5060E-05 | .2800E-01 | 20 | 19 | .4512E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 320 | -.8597E-05 | 22 | 2 | .5009E-05 | .2805E-01 | 20 | 19 | .4475E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 321 | -.8450E-05 | 22 | 2 | .4960E-05 | .2809E-01 | 20 | 19 | .4440E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 322 | -.8306E-05 | 22 | 2 | .4910E-05 | .2814E-01 | 20 | 19 | .4404E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 323 | -.8165E-05 | 22 | 2 | .4862E-05 | .2819E-01 | 20 | 19 | .4369E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 324 | -.8028E-05 | 22 | 2 | .4814E-05 | .2823E-01 | 20 | 19 | .4334E-02 | 141 | 0 | 21 | 2 | 20 | 11 |
| 325 | -.2883E-04 | 20 | 20 | .4839E-05 | -.2924E-01 | 20 | 20 | .4338E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 326 | -.2616E-04 | 20 | 20 | .4824E-05 | -.2611E-01 | 20 | 20 | .4297E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 327 | -.2387E-04 | 20 | 20 | .4805E-05 | -.2342E-01 | 20 | 20 | .4259E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 328 | -.2187E-04 | 20 | 20 | .4783E-05 | .2125E-01 | 19 | 19 | .4223E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 329 | -.2013E-04 | 20 | 20 | .4758E-05 | .2138E-01 | 19 | 19 | .4189E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 330 | -.1858E-04 | 20 | 20 | .4732E-05 | .2158E-01 | 19 | 19 | .4155E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 331 | -.1720E-04 | 20 | 20 | .4703E-05 | .2184E-01 | 19 | 19 | .4123E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 332 | -.1596E-04 | 20 | 20 | .4673E-05 | .2212E-01 | 19 | 19 | .4091E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 333 | -.1484E-04 | 20 | 20 | .4642E-05 | .2244E-01 | 19 | 19 | .4059E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 334 | -.1382E-04 | 20 | 20 | .4610E-05 | .2277E-01 | 19 | 19 | .4028E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 335 | -.1290E-04 | 20 | 20 | .4577E-05 | .2311E-01 | 19 | 19 | .3997E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 336 | -.1205E-04 | 20 | 20 | .4543E-05 | .2345E-01 | 19 | 19 | .3966E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 337 | -.1126E-04 | 20 | 20 | .4508E-05 | .2379E-01 | 19 | 19 | .3936E-02 | 140 | 0 | 21 | 2 | 20 | 11 |

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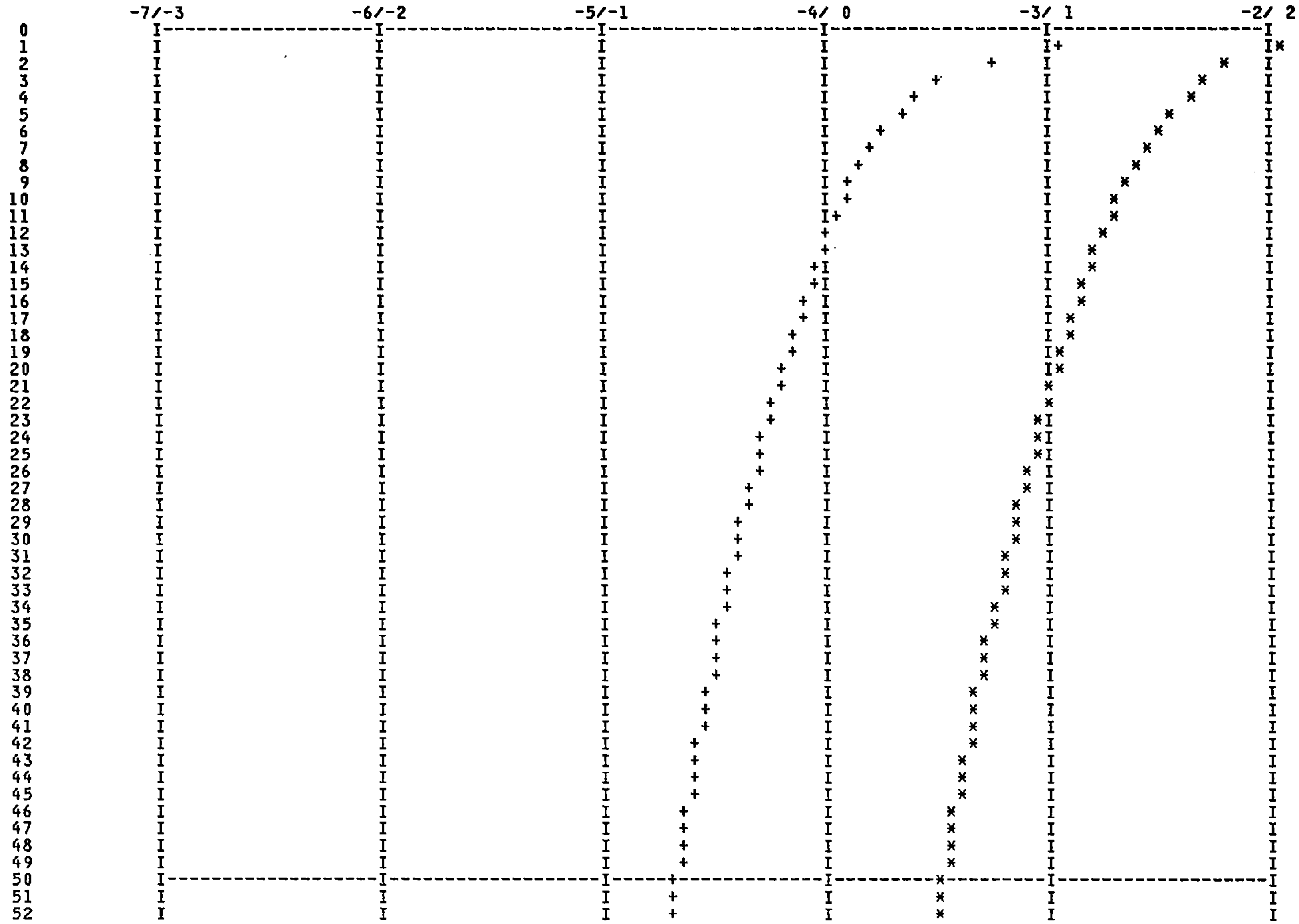
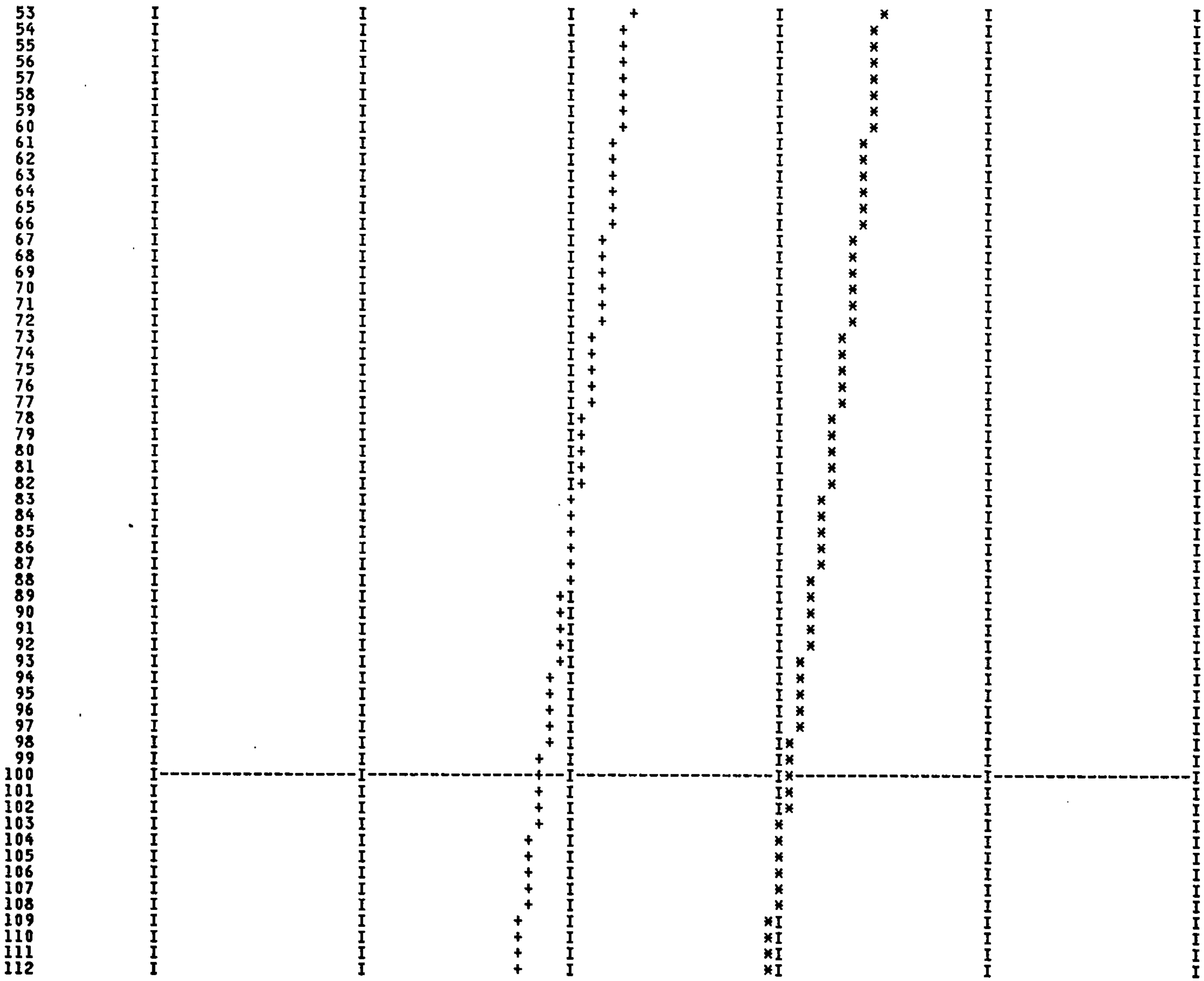
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 338 | -.1054E-04 | 20 | 20 | .4472E-05 | .2414E-01 | 19 | 19 | .3906E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 339 | -.9877E-05 | 20 | 20 | .4436E-05 | .2447E-01 | 19 | 19 | .3877E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 340 | -.9261E-05 | 20 | 20 | .4400E-05 | .2480E-01 | 19 | 19 | .3847E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 341 | -.8689E-05 | 20 | 20 | .4363E-05 | .2512E-01 | 19 | 19 | .3818E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 342 | -.8158E-05 | 20 | 20 | .4326E-05 | .2543E-01 | 19 | 19 | .3789E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 343 | -.7664E-05 | 20 | 20 | .4288E-05 | .2573E-01 | 19 | 19 | .3761E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 344 | -.7204E-05 | 20 | 20 | .4251E-05 | .2602E-01 | 19 | 19 | .3732E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 345 | -.6775E-05 | 20 | 20 | .4213E-05 | .2630E-01 | 19 | 19 | .3704E-02 | 140 | 0 | 21 | 2 | 20 | 11 |
| 346 | -.6531E-05 | 6 | 2 | .4175E-05 | .2657E-01 | 19 | 19 | .3676E-02 | 140 | 0 | 21 | 2 | 20 | 12 |
| 347 | -.4410E-04 | 11 | 20 | .4303E-05 | .2683E-01 | 19 | 19 | .3691E-02 | 139 | 0 | 21 | 2 | 20 | 12 |
| 348 | -.2961E-04 | 11 | 20 | .4294E-05 | .2707E-01 | 19 | 19 | .3674E-02 | 139 | 0 | 21 | 2 | 20 | 12 |
| 349 | -.2378E-04 | 11 | 20 | .4285E-05 | .2731E-01 | 19 | 19 | .3665E-02 | 139 | 0 | 21 | 2 | 20 | 12 |
| 350 | -.2196E-04 | 11 | 20 | .4279E-05 | .2754E-01 | 19 | 19 | .3661E-02 | 139 | 0 | 21 | 2 | 20 | 12 |
| ITER | DELMX | I | J | DELAVG | RESMX | I | J | RESAVG | KSUP | NPVD | JSHMAX | ISHMAX | JSHMIN | ISHMIN |

**NOTE:** IMPROVED SHOCK LOCATION, NEARLY ON A CONSTANT GRID LINE
21 OUT OF 28 MAX IS A REASONABLE INSET

CONVERGENCE HISTORY
INITIAL ERROR(*) IS .1103E-01 INITIAL RESIDUAL(+) IS .1111E+02

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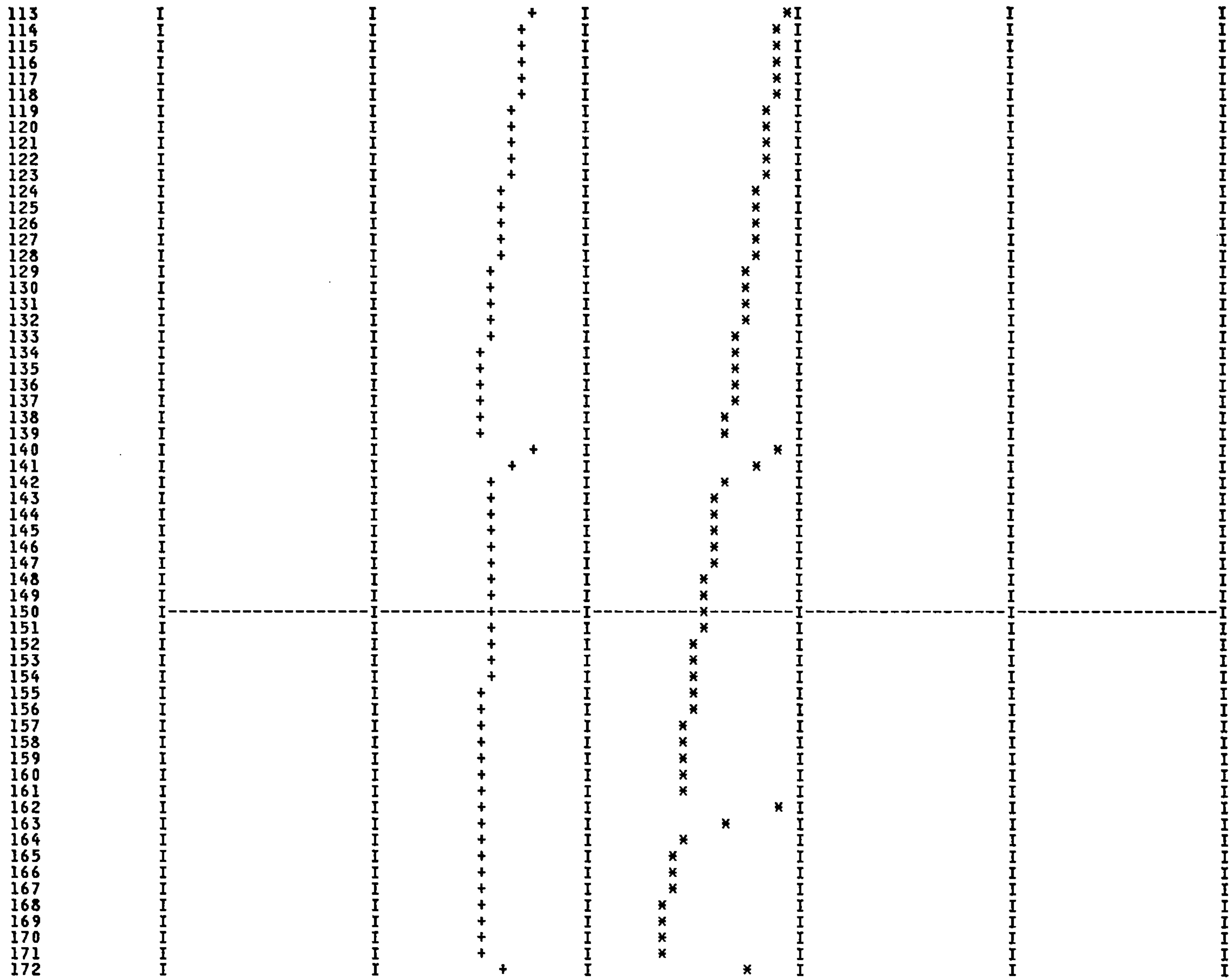
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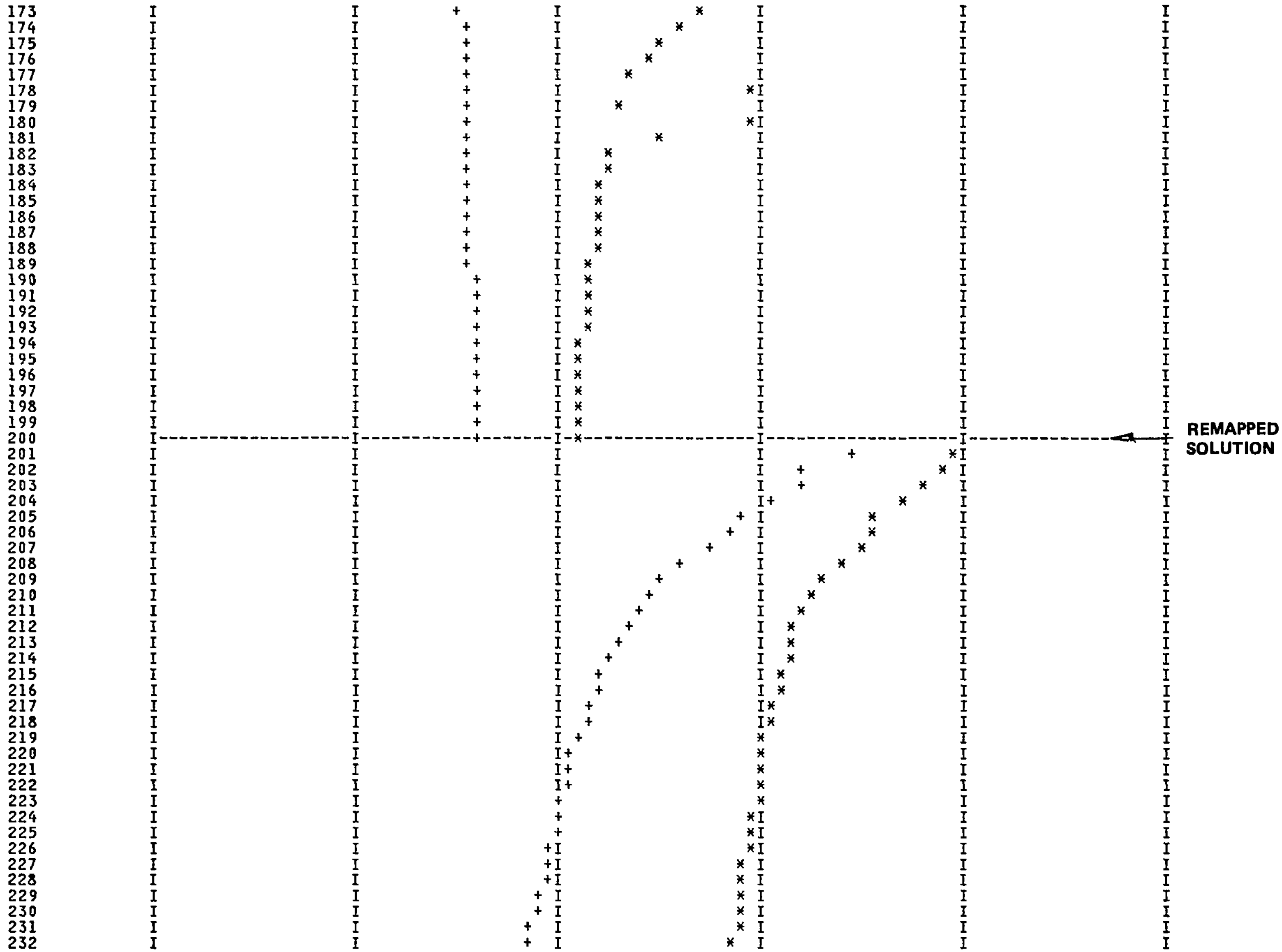
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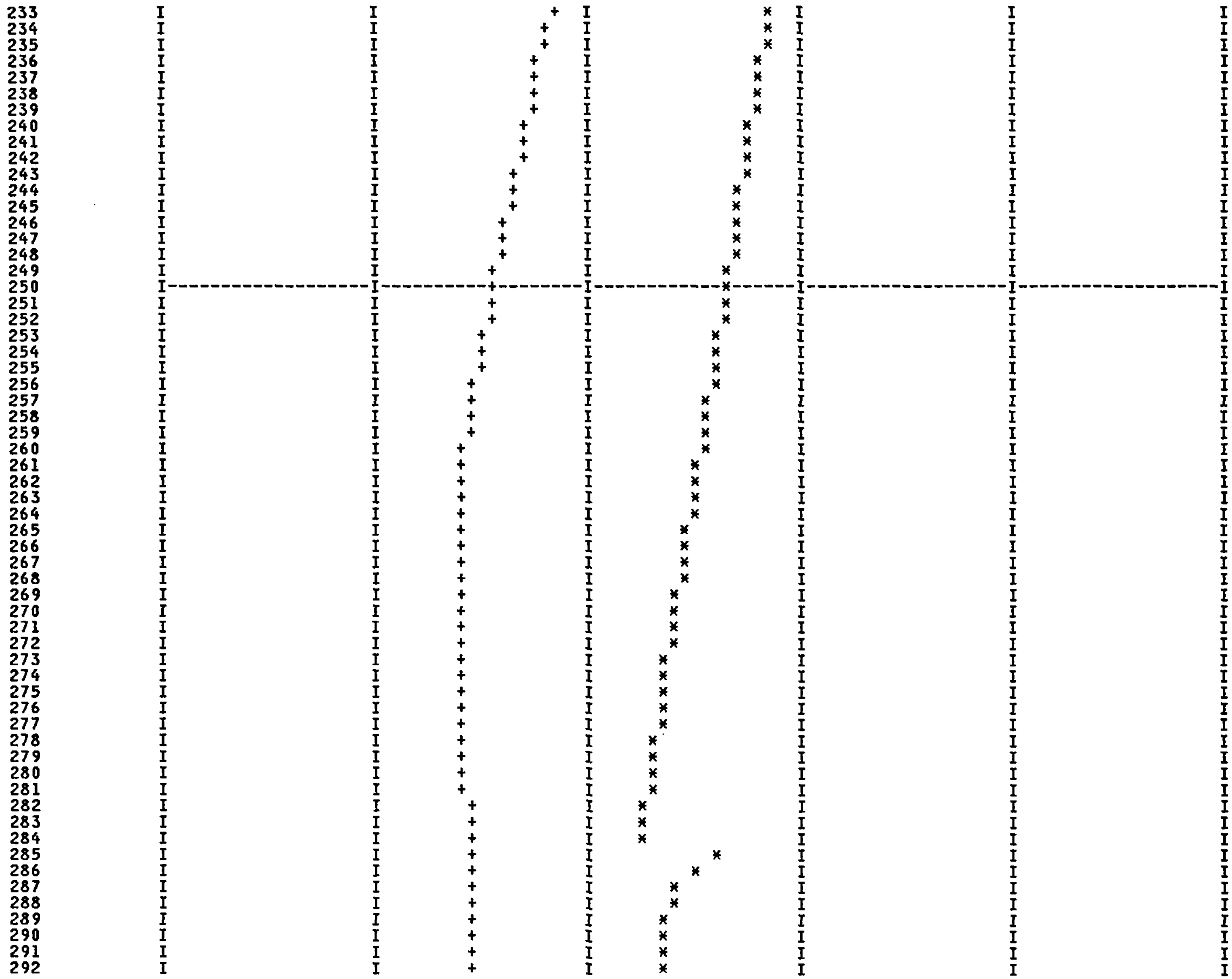
SOLUTION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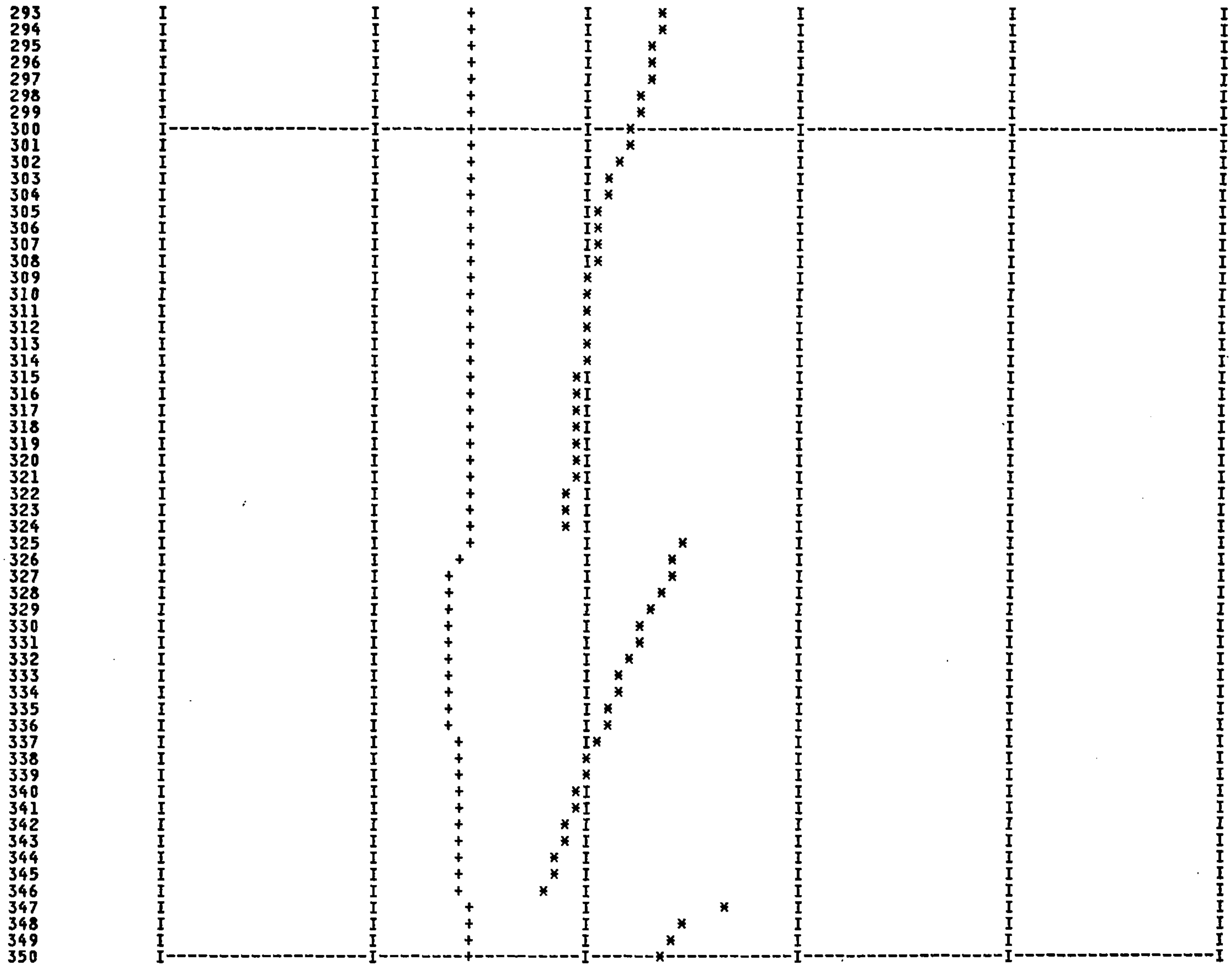
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BASIC RESULTS

| I | J | RHO | THE | F | U | V | MC | M | CP |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 | .33265E+00 | -.15708E+01 | -.82695E-01 | .12312E-14 | -.26645E-14 | .45197E-14 | .13741E+01 | .23227E+00 |
| 3 | 2 | .32632E+00 | -.14586E+01 | -.83982E-01 | -.33598E-01 | .60972E-02 | .52571E-01 | .13733E+01 | .23320E+00 |
| 4 | 2 | .31934E+00 | -.13464E+01 | -.83455E-01 | -.70793E-01 | .13043E-01 | .11076E+00 | .13705E+01 | .23625E+00 |
| 5 | 2 | .31311E+00 | -.12342E+01 | -.80685E-01 | -.10904E+00 | .15143E-01 | .16924E+00 | .13663E+01 | .24079E+00 |
| 6 | 2 | .30958E+00 | -.11220E+01 | -.75412E-01 | -.14878E+00 | .93095E-02 | .22898E+00 | .13619E+01 | .24565E+00 |
| 7 | 2 | .30876E+00 | -.10098E+01 | -.68494E-01 | -.18965E+00 | -.92128E-03 | .29110E+00 | .13583E+01 | .24961E+00 |
| 8 | 2 | .30992E+00 | -.89760E+00 | -.60971E-01 | -.23005E+00 | -.11883E-01 | .35343E+00 | .13560E+01 | .25212E+00 |
| 9 | 2 | .31236E+00 | -.78540E+00 | -.53599E-01 | -.26675E+00 | -.19852E-01 | .41024E+00 | .13540E+01 | .25435E+00 |
| 10 | 2 | .31513E+00 | -.67320E+00 | -.46806E-01 | -.29461E+00 | -.22054E-01 | .45265E+00 | .13491E+01 | .25983E+00 |
| 11 | 2 | .31765E+00 | -.56100E+00 | -.40604E-01 | -.30858E+00 | -.21281E-01 | .47286E+00 | .13377E+01 | .27253E+00 |
| 12 | 2 | .32005E+00 | -.44880E+00 | -.34891E-01 | -.30988E+00 | -.25511E-01 | .47381E+00 | .13214E+01 | .29105E+00 |
| 13 | 2 | .32357E+00 | -.33660E+00 | -.29827E-01 | -.30435E+00 | -.39494E-01 | .46620E+00 | .13053E+01 | .30968E+00 |
| 14 | 2 | .32948E+00 | -.22440E+00 | -.25880E-01 | -.28361E+00 | -.53132E-01 | .43646E+00 | .12833E+01 | .33553E+00 |
| 15 | 2 | .33743E+00 | -.11220E+00 | -.23278E-01 | -.15175E+00 | -.28515E-01 | .23025E+00 | .12084E+01 | .42782E+00 |
| 16 | 2 | .34375E+00 | -.71054E-14 | -.21977E-01 | .80487E+00 | .12109E+00 | .14348E+01 | .20068E+01 | -.24295E+00 |
| 17 | 2 | .34902E+00 | .11220E+00 | -.19427E-01 | .91651E+00 | .80639E-01 | .17290E+01 | .22934E+01 | -.35175E+00 |
| 18 | 2 | .35064E+00 | .22440E+00 | -.15074E-01 | .89625E+00 | .32839E-01 | .16714E+01 | .22562E+01 | -.34022E+00 |
| 19 | 2 | .35191E+00 | .33660E+00 | -.88519E-02 | .86271E+00 | .22303E-01 | .15906E+01 | .22067E+01 | -.32377E+00 |
| 20 | 2 | .35268E+00 | .44880E+00 | -.88775E-03 | .81869E+00 | .22715E-01 | .14903E+01 | .21494E+01 | -.30308E+00 |
| 21 | 2 | .35410E+00 | .56100E+00 | .82522E-02 | .76596E+00 | .34739E-01 | .13772E+01 | .20911E+01 | -.28008E+00 |
| 22 | 2 | .35629E+00 | .67320E+00 | .18224E-01 | .70893E+00 | .41812E-01 | .12616E+01 | .20419E+01 | -.25897E+00 |
| 23 | 2 | .35882E+00 | .78540E+00 | .28723E-01 | .63178E+00 | .35638E-01 | .11068E+01 | .19717E+01 | -.22604E+00 |
| 24 | 2 | .36083E+00 | .89760E+00 | .38059E-01 | .55593E+00 | .16723E-01 | .96177E+00 | .19203E+01 | -.19961E+00 |
| 25 | 2 | .36125E+00 | .10098E+01 | .47844E-01 | .48456E+00 | -.90640E-02 | .83296E+00 | .18926E+01 | -.18455E+00 |
| 26 | 2 | .35931E+00 | .11220E+01 | .57294E-01 | .39363E+00 | -.34557E-01 | .67352E+00 | .18548E+01 | -.16300E+00 |
| 27 | 2 | .35417E+00 | .12342E+01 | .65826E-01 | .28874E+00 | -.46632E-01 | .49456E+00 | .18183E+01 | -.14099E+00 |
| 28 | 2 | .34648E+00 | .13464E+01 | .72814E-01 | .18322E+00 | -.36871E-01 | .31432E+00 | .17936E+01 | -.12545E+00 |
| 29 | 2 | .33853E+00 | .14586E+01 | .77712E-01 | .86883E-01 | -.16998E-01 | .14853E+00 | .17827E+01 | -.11842E+00 |
| 30 | 2 | .33162E+00 | .15708E+01 | .80619E-01 | .11382E-13 | .26645E-14 | .19602E-13 | .17802E+01 | -.11678E+00 |

SURFACE RESULTS

POTENTIAL (W VELOCITY)

CROSS FLOW VELOCITIES

CROSS FLOW MACH NUMBER

TOTAL MACH NO.

PRESSURE COEFFICIENT

IF IOUT = 0, THIS DATA BLOCK IS REPEATED FOR ALL J's

SURFACE RESULTS

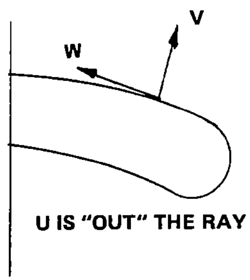
| I | X/XMAX | Y/XMAX | PSI | OMEG | CP | MC | U | V | W | BETA | VS | WS | UC | VC | WC | DELTA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | -.0000 | -.0218 | .81 | -90.00 | .2323 | .0000 | .8924 | -.0000 | .0000 | .00 | 0.00 | 0.00 | .0000 | -.0126 | .8923 | 0.00 |
| 3 | .1046 | -.0041 | 3.89 | -2.27 | .2332 | .0526 | .8914 | -.0000 | -.0341 | -2.19 | -77.78 | .06 | .0269 | -.0083 | .8916 | -77.72 |
| 4 | .2088 | .0149 | 7.74 | 4.07 | .2363 | .1108 | .8878 | -.0000 | -.0720 | -4.64 | -84.62 | .14 | .0489 | -.0035 | .8893 | -84.48 |
| 5 | .3118 | .0306 | 11.50 | 5.60 | .2408 | .1692 | .8819 | -.0000 | -.1101 | -7.12 | -89.99 | .61 | .0677 | .0054 | .8861 | -89.38 |
| 6 | .4126 | .0371 | 15.06 | 5.13 | .2456 | .2290 | .8740 | -.0000 | -.1491 | -9.68 | -94.03 | -.13 | .0821 | .0182 | .8826 | -94.15 |
| 7 | .5097 | .0347 | 18.35 | 3.90 | .2496 | .2911 | .8643 | -.0000 | -.1896 | -12.38 | -96.63 | -.94 | .0918 | .0313 | .8796 | -97.57 |
| 8 | .6019 | .0265 | 21.37 | 2.52 | .2521 | .3534 | .8533 | .0000 | -.2304 | -15.11 | -98.66 | -.80 | .0975 | .0422 | .8774 | -99.46 |
| 9 | .6879 | .0154 | 24.07 | 1.28 | .2543 | .4102 | .8414 | -.0000 | -.2675 | -17.64 | -98.96 | -.87 | .1015 | .0479 | .8757 | -99.83 |
| 10 | .7662 | .0045 | 26.45 | .33 | .2598 | .4527 | .8295 | -.0000 | -.2954 | -19.60 | -98.06 | -.95 | .1080 | .0469 | .8726 | -99.01 |
| 11 | .8356 | -.0047 | 28.49 | -.32 | .2725 | .4729 | .8186 | -.0000 | -.3093 | -20.70 | -97.02 | -.99 | .1214 | .0425 | .8655 | -98.02 |
| 12 | .8944 | -.0121 | 30.15 | -.78 | .2910 | .4738 | .8095 | -.0000 | -.3109 | -21.01 | -96.92 | -1.22 | .1410 | .0421 | .8546 | -98.14 |
| 13 | .9410 | -.0188 | 31.43 | -1.14 | .3097 | .4662 | .8026 | -.0000 | -.3069 | -20.93 | -97.47 | -1.81 | .1611 | .0463 | .8428 | -99.28 |
| 14 | .9745 | -.0241 | 32.33 | -1.42 | .3355 | .4365 | .7979 | -.0000 | -.2885 | -19.88 | -93.61 | -3.80 | .1858 | .0326 | .8272 | -97.41 |
| 15 | .9944 | -.0253 | 32.86 | -1.46 | .4278 | .2302 | .7955 | -.0000 | -.1544 | -10.98 | -60.21 | -17.46 | .3040 | -.0407 | .7501 | -77.67 |
| 16 | 1.0000 | -.0206 | 33.00 | -1.18 | -.2429 | 1.4348 | .7960 | .0000 | .8139 | 45.64 | -23.91 | 36.39 | .3023 | .7886 | .7634 | 12.49 |
| 17 | .9910 | -.0117 | 32.76 | -.68 | -.3517 | 1.7290 | .8018 | .0000 | .9201 | 48.93 | 55.23 | -.31 | -.1930 | .5311 | 1.0817 | 54.92 |
| 18 | .9666 | -.0016 | 32.12 | -.10 | -.3402 | 1.6714 | .8132 | 0.0000 | .8969 | 47.80 | 70.52 | -2.12 | -.2733 | .3307 | 1.1320 | 68.39 |
| 19 | .9286 | .0092 | 31.09 | .57 | -.3238 | 1.5906 | .8298 | -.0000 | .8630 | 46.12 | 75.32 | -2.00 | -.2818 | .2450 | 1.1375 | 73.31 |
| 20 | .8780 | .0201 | 29.70 | 1.31 | -.3031 | 1.4903 | .8511 | -.0000 | .8190 | 43.90 | 77.15 | -1.66 | -.2717 | .1991 | 1.1321 | 75.48 |
| 21 | .8166 | .0319 | 27.95 | 2.24 | -.2801 | 1.3772 | .8761 | -.0000 | .7667 | 41.19 | 76.99 | -1.55 | -.2522 | .1830 | 1.1217 | 75.44 |
| 22 | .7460 | .0451 | 25.89 | 3.46 | -.2590 | 1.2616 | .9037 | -.0000 | .7102 | 38.16 | 76.19 | -1.43 | -.2327 | .1729 | 1.1122 | 74.76 |
| 23 | .6675 | .0591 | 23.52 | 5.06 | -.2260 | 1.1068 | .9329 | -.0000 | .6328 | 34.15 | 75.67 | -1.26 | -.2009 | .1530 | 1.0987 | 74.41 |
| 24 | .5825 | .0718 | 20.86 | 7.03 | -.1996 | .9618 | .9611 | -.0000 | .5562 | 30.06 | 76.16 | -1.13 | -.1762 | .1231 | 1.0895 | 75.03 |
| 25 | .4919 | .0804 | 17.94 | 9.28 | -.1846 | .8330 | .9888 | -.0000 | .4846 | 26.11 | 78.03 | -1.29 | -.1603 | .0865 | 1.0860 | 76.74 |
| 26 | .3972 | .0824 | 14.76 | 11.72 | -.1630 | .6735 | 1.0139 | -.0000 | .3951 | 21.29 | 79.84 | -.34 | -.1296 | .0467 | 1.0795 | 79.50 |
| 27 | .2994 | .0749 | 11.33 | 14.04 | -.1410 | .4946 | 1.0348 | -.0000 | .2925 | 15.78 | 82.26 | .34 | -.0878 | .0169 | 1.0716 | 82.60 |
| 28 | .2000 | .0587 | 7.71 | 16.37 | -.1254 | .3143 | 1.0500 | -.0000 | .1869 | 10.09 | 83.58 | .02 | -.0473 | .0078 | 1.0654 | 83.60 |
| 29 | .1000 | .0397 | 4.00 | 21.67 | -.1184 | .1485 | 1.0588 | -.0000 | .0885 | 4.78 | 78.79 | .05 | -.0182 | .0112 | 1.0623 | 78.84 |
| 30 | .0000 | .0218 | .81 | 90.00 | -.1168 | .0000 | 1.0616 | .0000 | .0000 | .00 | 4514.54 | 2.78 | .0000 | .0150 | 1.0615 | 0.00 |
| I | X/XMAX | Y/XMAX | PSI | OMEG | CP | MC | U | V | W | BETA | VS | WS | UC | VC | WC | DELTA |

SURFACE VELOCITIES (U, V, W)

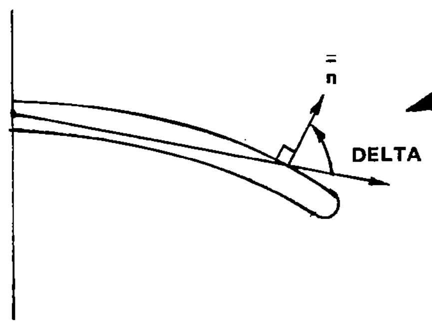
ANGLE BETWEEN THE RAY AND THE VELOCITY VECTOR (BETA)

CARTESIAN VELOCITY COMPONENTS (UC, VC, WC)

THE ANGLE BETWEEN THE SURFACE NORMAL AND THE SPHERICAL COORDINATE (DELTA)




U IS "OUT" THE RAY



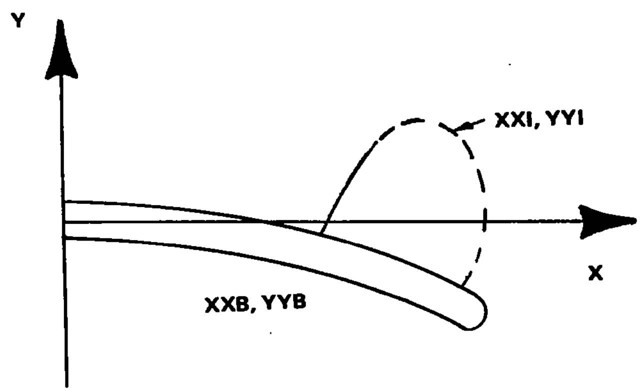
IMCMIN= 6 MCMIN= .22898

CROSSFLOW SONIC LINE

NUMBER OF POINTS 16

| J | XXI | YYI |
|---|---|---|
| 1 | .64915 | -.01485 |
| 2 | .65189 | -.00885 |
| 3 | .65490 | .00012 |
| 4 | .65618 | .01529 |
| 5 | .65733 | .03459 |
| 6 | .65577 | .06236 |
| 7 | .64940 | .10139 |
| 8 | .62887 | .16375 |
| 9 | .52791 | .26602 |
| 10 | .49204 | .24882 |
| 11 | .46812 | .22112 |
| 12 | .45133 | .18855 |
| 13 | .43875 | .15371 |
| 14 | .42725 | .11815 |
| 15 | .41334 | .08222 |
| 16 | .39316 | .04447 |

X, Y LOCATION OF CROSS FLOW SONIC LINE



CONICAL FORCE DISTRIBUTIONS, BODY AND SHOCK LOCATIONS

| I | X(I) | CL | CD | OMEG | XXB | YYB | RB | XXS | YYS | RS | RS/RB |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | -1.5708 | .1056 | .0240 | -90.0000 | -.0000 | -.0142 | .0142 | -.0000 | -.6011 | .6011 | 42.4627 |
| 3 | -1.4586 | .1061 | .0241 | -83.5714 | .0679 | -.0027 | .0680 | .0983 | -.5960 | .6040 | 8.8843 |
| 4 | -1.3464 | .1071 | .0241 | -77.1429 | .1356 | .0096 | .1359 | .1950 | -.5815 | .6133 | 4.5125 |
| 5 | -1.2342 | .1077 | .0230 | -70.7143 | .2025 | .0198 | .2034 | .2888 | -.5584 | .6287 | 3.0902 |
| 6 | -1.1220 | .1070 | .0206 | -64.2857 | .2679 | .0241 | .2690 | .3785 | -.5275 | .6492 | 2.4135 |
| 7 | -1.0098 | .1042 | .0177 | -57.8571 | .3310 | .0225 | .3318 | .4628 | -.4894 | .6736 | 2.0302 |
| 8 | -.8976 | .0990 | .0149 | -51.4286 | .3909 | .0172 | .3913 | .5404 | -.4451 | .7001 | 1.7893 |
| 9 | -.7854 | .0921 | .0130 | -45.0000 | .4467 | .0100 | .4468 | .6100 | -.3955 | .7270 | 1.6272 |
| 10 | -.6732 | .0846 | .0119 | -38.5714 | .4976 | .0029 | .4976 | .6706 | -.3419 | .7527 | 1.5128 |
| 11 | -.5610 | .0770 | .0111 | -32.1429 | .5426 | -.0031 | .5426 | .7217 | -.2860 | .7763 | 1.4306 |
| 12 | -.4488 | .0676 | .0094 | -25.7143 | .5808 | -.0079 | .5809 | .7655 | -.2309 | .7995 | 1.3765 |
| 13 | -.3366 | .0544 | .0069 | -19.2857 | .6111 | -.0122 | .6112 | .8029 | -.1770 | .8222 | 1.3451 |
| 14 | -.2244 | .0388 | .0056 | -12.8571 | .6328 | -.0156 | .6330 | .8343 | -.1231 | .8433 | 1.3322 |
| 15 | -.1122 | .0230 | .0079 | -6.4286 | .6457 | -.0164 | .6460 | .8602 | -.0678 | .8629 | 1.3358 |
| 16 | -.0000 | .0028 | -.0044 | -.0000 | .6494 | -.0134 | .6495 | .8811 | -.0088 | .8811 | 1.3566 |
| 17 | .1122 | .0274 | -.0044 | 6.4286 | .6435 | -.0076 | .6436 | .8969 | .0561 | .8987 | 1.3964 |
| 18 | .2244 | .0484 | .0001 | 12.8571 | .6277 | -.0010 | .6277 | .9068 | .1289 | .9159 | 1.4591 |
| 19 | .3366 | .0647 | .0037 | 19.2857 | .6030 | .0060 | .6031 | .9113 | .2117 | .9356 | 1.5514 |
| 20 | .4488 | .0761 | .0063 | 25.7143 | .5702 | .0130 | .5703 | .9079 | .3051 | .9578 | 1.6794 |
| 21 | .5610 | .0826 | .0074 | 32.1429 | .5303 | .0207 | .5307 | .8916 | .4072 | .9802 | 1.8470 |
| 22 | .6732 | .0861 | .0080 | 38.5714 | .4844 | .0293 | .4853 | .8615 | .5166 | 1.0045 | 2.0699 |
| 23 | .7854 | .0823 | .0083 | 45.0000 | .4335 | .0384 | .4352 | .8152 | .6306 | 1.0306 | 2.3683 |
| 24 | .8976 | .0779 | .0091 | 51.4286 | .3782 | .0466 | .3811 | .7512 | .7460 | 1.0587 | 2.7781 |
| 25 | 1.0098 | .0759 | .0106 | 57.8571 | .3195 | .0522 | .3237 | .6686 | .8590 | 1.0885 | 3.3629 |
| 26 | 1.1220 | .0696 | .0114 | 64.2857 | .2579 | .0535 | .2634 | .5665 | .9644 | 1.1185 | 4.2464 |
| 27 | 1.2342 | .0614 | .0114 | 70.7143 | .1944 | .0486 | .2004 | .4455 | 1.0559 | 1.1460 | 5.7182 |
| 28 | 1.3464 | .0550 | .0108 | 77.1429 | .1299 | .0381 | .1354 | .3076 | 1.1268 | 1.1681 | 8.6289 |
| 29 | 1.4586 | .0519 | .0103 | 83.5714 | .0650 | .0258 | .0699 | .1572 | 1.1718 | 1.1823 | 16.9132 |
| 30 | 1.5708 | .0510 | .0101 | 90.0000 | .0000 | .0142 | .0142 | .0000 | 1.1870 | 1.1870 | 83.8522 |

BODY LOCATION

SHOCK LOCATION

CL = .4508 CD = .0664

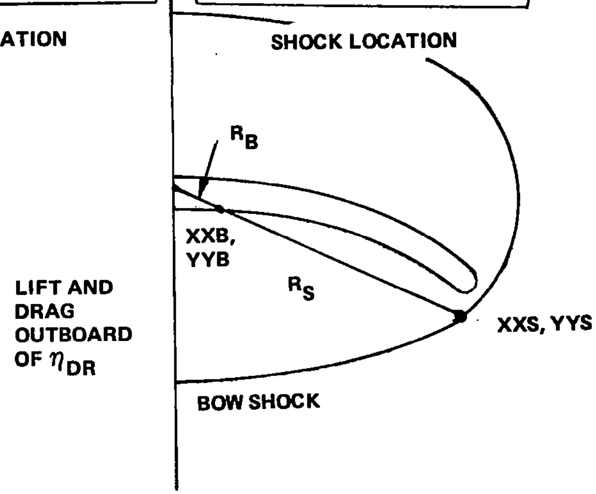
CLU= .1989 CLL= .2520

CDU= .0215 CDL= .0449

L/D= 6.789 L/D UPPER = 9.248 L/D LOWER = 5.6118

INITL= 10 IFINL= 23

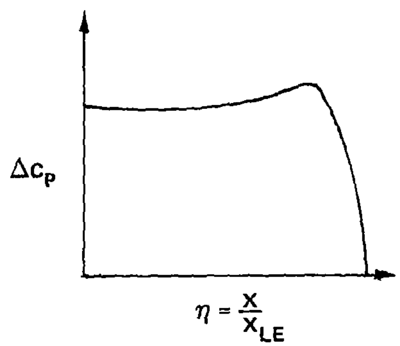
ETADR= .750 CL(ETADR)= .1518 CD(ETADR)= .0142



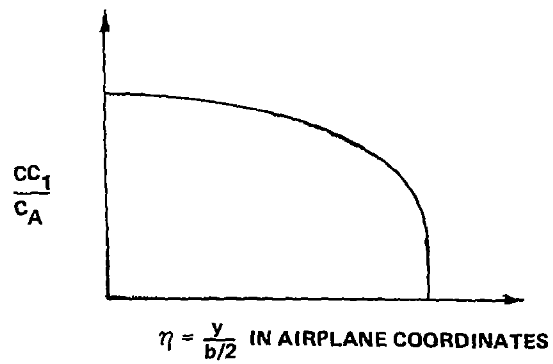
DELTA CP , FLAT PLATE LINEAR DCP , AND SPANLOAD DISTRIBUTION

| I | ETASPN | CPU | CPL | DELTACP | DCPLIN | CCL/CA |
|---|---|---|---|---|---|---|
| 1 | .0000 | -.1168 | .2323 | .3491 | .2870 | .6981 |
| 2 | .1000 | -.1184 | .2332 | .3516 | .2885 | .6974 |
| 3 | .2000 | -.1254 | .2360 | .3614 | .2929 | .6888 |
| 4 | .2994 | -.1410 | .2402 | .3812 | .3008 | .6357 |
| 5 | .3972 | -.1630 | .2449 | .4079 | .3127 | .5778 |
| 6 | .4919 | -.1846 | .2489 | .4334 | .3297 | .5116 |
| 7 | .5825 | -.1996 | .2516 | .4512 | .3531 | .4411 |
| 8 | .6675 | -.2260 | .2538 | .4799 | .3855 | .3689 |
| 9 | .7460 | -.2590 | .2584 | .5174 | .4310 | .2948 |
| 10 | .8166 | -.2801 | .2691 | .5491 | .4973 | .2216 |
| 11 | .8780 | -.3031 | .2859 | .5890 | .5997 | .1527 |
| 12 | .9286 | -.3238 | .3047 | .6285 | .7736 | .0913 |
| 13 | .9666 | -.3402 | .3295 | .6697 | 1.1207 | .0419 |
| 14 | .9910 | -.3517 | .4119 | .7637 | 2.1394 | .0070 |
| 15 | 1.0000 | -.2429 | -.2429 | 0.0000 | 0.0000 | 0.0000 |
| I | ETASPN | CPU | CPL | DELTACP | DCPLIN | CCL/CA |

LINEAR THEORY FOR AN UNCAMBERED WING




SPANWISE LOADING




SPANLOAD DISTRIBUTION

MODIFICATION OF PRESSURES TO ACCOUNT FOR NON-CONICAL GEOMETRY

| I | MCON | NUCON | YIN | DNY | DNZ | DNX | CPP | CPNC | DELMCH | DELNUD |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.37414 | .14392 | -.00000 | -.16186 | .98572 | -.04639 | .23227 | .10977 | .12070 | 3.50765 |
| 2 | 1.37329 | .14349 | 1.08644 | -.17451 | .98370 | -.04324 | .23320 | .11522 | .11581 | 3.36312 |
| 3 | 1.37048 | .14209 | 2.16809 | -.17544 | .98365 | -.04054 | .23625 | .12332 | .11016 | 3.19441 |
| 4 | 1.36632 | .14003 | 3.23809 | -.11481 | .99220 | -.04791 | .24079 | .13457 | .10270 | 2.97194 |
| 5 | 1.36189 | .13783 | 4.28474 | -.01460 | .99757 | -.06791 | .24565 | .14637 | .09512 | 2.74604 |
| 6 | 1.35829 | .13605 | 5.29376 | .05990 | .99449 | -.08579 | .24961 | .15793 | .08711 | 2.50866 |
| 7 | 1.35602 | .13493 | 6.25135 | .11174 | .98888 | -.09799 | .25212 | .17227 | .07519 | 2.15979 |
| 8 | 1.35400 | .13393 | 7.14383 | .13668 | .98531 | -.10242 | .25435 | .18587 | .06395 | 1.83194 |
| 9 | 1.34907 | .13150 | 7.95781 | .13495 | .98592 | -.09876 | .25983 | .19665 | .05852 | 1.67135 |
| 10 | 1.33773 | .12594 | 8.67827 | .12653 | .98753 | -.09363 | .27253 | .21005 | .05714 | 1.62366 |
| 11 | 1.32143 | .11800 | 9.28871 | .12568 | .98764 | -.09361 | .29105 | .22611 | .05841 | 1.64744 |
| 12 | 1.30530 | .11023 | 9.77304 | .15779 | .98099 | -.11301 | .30968 | .24230 | .05964 | 1.66812 |
| 13 | 1.28333 | .09978 | 10.12055 | .12981 | .98679 | -.09383 | .33553 | .26949 | .05711 | 1.57467 |
| 14 | 1.20837 | .06572 | 10.32735 | -.19116 | .95853 | .11723 | .42782 | .36428 | .05105 | 1.31238 |
| 15 | 2.00681 | .46369 | 10.38560 | -.64629 | .19689 | .41797 | -.24295 | -.26400 | .04648 | 1.27056 |
| 16 | 2.29337 | .59544 | 10.29171 | .45743 | .83763 | -.29644 | -.35175 | -.35857 | .02305 | .57682 |
| 17 | 2.25621 | .57904 | 10.03923 | .31048 | .92933 | -.19826 | -.34022 | -.33684 | -.01047 | -.26693 |
| 18 | 2.20669 | .55686 | 9.64427 | .23653 | .96028 | -.14700 | -.32377 | -.32488 | .00323 | .08350 |
| 19 | 2.14940 | .53075 | 9.11869 | .19226 | .97446 | -.11597 | -.30308 | -.30839 | .01423 | .37426 |
| 20 | 2.09114 | .50370 | 8.48092 | .18457 | .97706 | -.10621 | -.28008 | -.29066 | .02616 | .69949 |
| 21 | 2.04189 | .48045 | 7.74731 | .17981 | .97912 | -.09473 | -.25897 | -.27857 | .04560 | 1.23386 |
| 22 | 1.97170 | .44675 | 6.93251 | .16415 | .98332 | -.07792 | -.22604 | -.25689 | .06553 | 1.80409 |
| 23 | 1.92026 | .42163 | 6.04916 | .12399 | .99065 | -.05530 | -.19961 | -.23910 | .07841 | 2.18525 |
| 24 | 1.89259 | .40799 | 5.10904 | .06009 | .99761 | -.02794 | -.18455 | -.23080 | .08882 | 2.48971 |
| 25 | 1.85485 | .38924 | 4.12484 | -.02568 | .99932 | .00168 | -.16300 | -.21680 | .09843 | 2.78168 |
| 26 | 1.81830 | .37094 | 3.10950 | -.12586 | .99144 | .02851 | -.14099 | -.20178 | .10603 | 3.01924 |
| 27 | 1.79359 | .35848 | 2.07721 | -.18218 | .98240 | .04100 | -.12545 | -.19155 | .11172 | 3.19675 |
| 28 | 1.78268 | .35297 | 1.03896 | -.18254 | .98220 | .04417 | -.11842 | -.18866 | .11735 | 3.36338 |
| 29 | 1.78018 | .35170 | .00000 | -.17354 | .98374 | .04632 | -.11678 | -.19007 | .12243 | 3.50885 |
| I | MCON | NUCON | YIN | DNY | DNZ | DNX | CPP | CPNC | DELMCH | DELNUD |
| | $M_{CONICAL}$ | $\nu$ CONICAL | | | | | $C_{P_{CONICAL}}$ | $C_{P_{NON\text{-}CONICAL}}$ | $\Delta M$ | $\Delta \nu$ |

DELTA CP FROM NON CONICAL CORRECTION

| I | ETASPN | CPU | CPL | DELTACP |
|---|---|---|---|---|
| 1 | .0000 | -.1901 | .1098 | .2998 |
| 2 | .1000 | -.1887 | .1150 | .3036 |
| 3 | .2000 | -.1916 | .1226 | .3142 |
| 4 | .2994 | -.2018 | .1332 | .3350 |
| 5 | .3972 | -.2168 | .1446 | .3614 |
| 6 | .4919 | -.2308 | .1558 | .3866 |
| 7 | .5825 | -.2391 | .1692 | .4083 |
| 8 | .6675 | -.2569 | .1826 | .4395 |
| 9 | .7460 | -.2786 | .1939 | .4724 |
| 10 | .8166 | -.2907 | .2064 | .4970 |
| 11 | .8780 | -.3084 | .2216 | .5300 |
| 12 | .9286 | -.3249 | .2380 | .5629 |
| 13 | .9666 | -.3368 | .2631 | .6000 |
| 14 | .9910 | -.3586 | .3479 | .7065 |
| 15 | 1.0000 | -.2640 | -.2640 | 0.0000 |
| I | ETASPN | CPU | CPL | DELTACP |

NON-CONICAL FORCE RESULTS

CN= .4110

PURE CONICAL FORCE COEFFICIENT RESULTS

CN (FROM DELTA CP ) = .4599    CN (FROM SPANLOAD) =, .4590

SPAN E= .8694

CL= .45084

CD= .06640

CN= .45480    CA= -.02878

A = .6608

EMINF= 1.6200    ALP=12.0000

JOBN ← REPEAT JOB IDENTIFICATION

FINISH 1ST GRID AND REPEAT SAME OUTPUT ON 2ND GRID

X0= .64825   Y0= -.014260   Y1= .014260   NM= 58

MAPPED BODY (B) AND SHOCK (C) LOCATIONS - WITH 1ST (PR) AND 2ND (SEC) DERIVATIVES

| I | X | B | BPR | BSEC | C | CPR | CSEC |
|---|---|---|---|---|---|---|---|
| 2 | -.15708E+01 | .33265E+00 | 0. | -.19717E+01 | .95129E+00 | 0. | -.15491E+00 |
| 3 | -.15147E+01 | .32955E+00 | -.56365E-01 | -.37777E-01 | .95104E+00 | -.91102E-02 | -.16987E+00 |
| 4 | -.14586E+01 | .32632E+00 | -.59465E-01 | -.72759E-01 | .95027E+00 | -.18711E-01 | -.17240E+00 |
| 5 | -.14025E+01 | .32287E+00 | -.62241E-01 | -.26173E-01 | .94895E+00 | -.29010E-01 | -.19476E+00 |
| 6 | -.13464E+01 | .31934E+00 | -.61334E-01 | .58503E-01 | .94701E+00 | -.40450E-01 | -.21310E+00 |
| 7 | -.12903E+01 | .31599E+00 | -.55514E-01 | .14897E+00 | .94441E+00 | -.52813E-01 | -.22766E+00 |
| 8 | -.12342E+01 | .31311E+00 | -.45098E-01 | .22236E+00 | .94109E+00 | -.66210E-01 | -.24995E+00 |
| 9 | -.11781E+01 | .31093E+00 | -.31493E-01 | .26266E+00 | .93698E+00 | -.80097E-01 | -.24512E+00 |
| 10 | -.11220E+01 | .30958E+00 | -.18180E-01 | .21198E+00 | .93210E+00 | -.94184E-01 | -.25711E+00 |
| 11 | -.10659E+01 | .30889E+00 | -.72624E-02 | .17722E+00 | .92641E+00 | -.10782E+00 | -.22892E+00 |
| 12 | -.10098E+01 | .30876E+00 | .21319E-02 | .15770E+00 | .92000E+00 | -.12044E+00 | -.22094E+00 |
| 13 | -.95370E+00 | .30913E+00 | .10263E-01 | .13219E+00 | .91290E+00 | -.13147E+00 | -.17231E+00 |
| 14 | -.89760E+00 | .30992E+00 | .16857E-01 | .10288E+00 | .90525E+00 | -.14028E+00 | -.14182E+00 |
| 15 | -.84150E+00 | .31102E+00 | .21762E-01 | .71987E-01 | .89716E+00 | -.14648E+00 | -.79428E-01 |
| 16 | -.78540E+00 | .31236E+00 | .24390E-01 | .21677E-01 | .88882E+00 | -.14956E+00 | -.30183E-01 |
| 17 | -.72930E+00 | .31376E+00 | .24741E-01 | -.91345E-02 | .88038E+00 | -.14929E+00 | .39753E-01 |
| 18 | -.67320E+00 | .31513E+00 | .23797E-01 | -.24526E-01 | .87207E+00 | -.14534E+00 | .10109E+00 |
| 19 | -.61710E+00 | .31643E+00 | .22453E-01 | -.23401E-01 | .86407E+00 | -.13756E+00 | .17613E+00 |
| 20 | -.56100E+00 | .31765E+00 | .21481E-01 | -.11247E-01 | .85663E+00 | -.12575E+00 | .24499E+00 |
| 21 | -.50490E+00 | .31884E+00 | .21374E-01 | .74199E-02 | .84996E+00 | -.10977E+00 | .32487E+00 |
| 22 | -.44880E+00 | .32005E+00 | .23798E-01 | .79021E-01 | .84431E+00 | -.89407E-01 | .40098E+00 |
| 23 | -.39270E+00 | .32151E+00 | .31342E-01 | .18993E+00 | .83993E+00 | -.64664E-01 | .48113E+00 |
| 24 | -.33660E+00 | .32357E+00 | .42078E-01 | .19280E+00 | .83706E+00 | -.35345E-01 | .56408E+00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 25 | -.28050E+00 | .32623E+00 | .52677E-01 | .18508E+00 | .83596E+00 | -.18011E-02 | .63179E+00 |
| 26 | -.22440E+00 | .32948E+00 | .62713E-01 | .17270E+00 | .83686E+00 | .35949E-01 | .71401E+00 |
| 27 | -.16830E+00 | .33327E+00 | .70875E-01 | .11828E+00 | .84000E+00 | .77110E-01 | .75342E+00 |
| 28 | -.11220E+00 | .33743E+00 | .66511E-01 | -.27387E+00 | .84551E+00 | .12124E+00 | .81975E+00 |
| 29 | -.56100E-01 | .34073E+00 | .56348E-01 | -.88442E-01 | .85360E+00 | .16727E+00 | .82122E+00 |
| 30 | -.71054E-14 | .34375E+00 | .60385E-01 | .23239E+00 | .86428E+00 | .21433E+00 | .85667E+00 |
| 31 | .56100E-01 | .34751E+00 | .46987E-01 | -.71006E+00 | .87765E+00 | .26139E+00 | .82107E+00 |
| 32 | .11220E+00 | .34902E+00 | .21370E-01 | -.20322E+00 | .89360E+00 | .30738E+00 | .81858E+00 |
| 33 | .16830E+00 | .34990E+00 | .14410E-01 | -.44919E-01 | .91214E+00 | .35152E+00 | .75472E+00 |
| 34 | .22440E+00 | .35064E+00 | .12624E-01 | -.18737E-01 | .93304E+00 | .39279E+00 | .71670E+00 |
| 35 | .28050E+00 | .35132E+00 | .11280E-01 | -.29180E-01 | .95621E+00 | .43075E+00 | .63670E+00 |
| 36 | .33660E+00 | .35191E+00 | .89819E-02 | -.52749E-01 | .98137E+00 | .46466E+00 | .57224E+00 |
| 37 | .39270E+00 | .35233E+00 | .69124E-02 | -.21028E-01 | .10083E+01 | .49439E+00 | .48759E+00 |
| 38 | .44880E+00 | .35268E+00 | .84703E-02 | .76567E-01 | .10368E+01 | .51954E+00 | .40894E+00 |
| 39 | .50490E+00 | .35328E+00 | .12656E-01 | .72647E-01 | .10666E+01 | .54017E+00 | .32647E+00 |
| 40 | .56100E+00 | .35410E+00 | .16430E-01 | .61908E-01 | .10975E+01 | .55618E+00 | .24456E+00 |
| 41 | .61710E+00 | .35512E+00 | .19460E-01 | .46124E-01 | .11290E+01 | .56765E+00 | .16424E+00 |
| 42 | .67320E+00 | .35629E+00 | .21554E-01 | .28508E-01 | .11611E+01 | .57462E+00 | .84273E-01 |
| 43 | .72930E+00 | .35754E+00 | .22562E-01 | .74325E-02 | .11935E+01 | .57702E+00 | .13112E-02 |
| 44 | .78540E+00 | .35882E+00 | .21587E-01 | -.42193E-01 | .12259E+01 | .57486E+00 | -.78216E-01 |
| 45 | .84150E+00 | .35996E+00 | .17915E-01 | -.88707E-01 | .12580E+01 | .56794E+00 | -.16849E+00 |
| 46 | .89760E+00 | .36083E+00 | .11880E-01 | -.12643E+00 | .12896E+01 | .55614E+00 | -.25230E+00 |
| 47 | .95370E+00 | .36129E+00 | .37906E-02 | -.16197E+00 | .13204E+01 | .53921E+00 | -.35120E+00 |
| 48 | .10098E+01 | .36125E+00 | -.60967E-02 | -.19052E+00 | .13501E+01 | .51694E+00 | -.44299E+00 |
| 49 | .10659E+01 | .36061E+00 | -.17304E-01 | -.20903E+00 | .13784E+01 | .48913E+00 | -.54814E+00 |
| 50 | .11220E+01 | .35931E+00 | -.30563E-01 | -.26367E+00 | .14050E+01 | .45556E+00 | -.64898E+00 |
| 51 | .11781E+01 | .35718E+00 | -.45777E-01 | -.27869E+00 | .14295E+01 | .41621E+00 | -.75371E+00 |
| 52 | .12342E+01 | .35417E+00 | -.59479E-01 | -.20983E+00 | .14517E+01 | .37089E+00 | -.86183E+00 |
| 53 | .12903E+01 | .35051E+00 | -.68603E-01 | -.11543E+00 | .14711E+01 | .32000E+00 | -.95251E+00 |
| 54 | .13464E+01 | .34648E+00 | -.72264E-01 | -.15098E-01 | .14876E+01 | .26354E+00 | -.10605E+01 |
| 55 | .14025E+01 | .34240E+00 | -.70812E-01 | .66889E-01 | .15007E+01 | .20247E+00 | -.11167E+01 |
| 56 | .14586E+01 | .33853E+00 | -.65992E-01 | .10493E+00 | .15103E+01 | .13727E+00 | -.12077E+01 |
| 57 | .15147E+01 | .33500E+00 | -.61581E-01 | .52309E-01 | .15161E+01 | .69407E-01 | -.12116E+01 |
| 58 | .15708E+01 | .33162E+00 | 0. | .21431E+01 | .15181E+01 | 0. | -.12629E+01 |

| I | X | B | BPR | BSEC | C | CPR | CSEC |
|---|---|---|---|---|---|---|---|

MAPPING METRIC AND FREESTREAM VELOCITIES AT GRID POINTS

| I | J | RHO | THE | PSI | OMEG | H | UI | VI | WI |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 | .33265E+00 | -.15708E+01 | .14155E-01 | -.15708E+01 | .18209E+01 | .12312E-14 | -.22174E+00 | .97511E+00 |
| 3 | 2 | .32955E+00 | -.15147E+01 | .35018E-01 | -.24543E+00 | .18349E+01 | -.33579E-01 | -.21616E+00 | .97578E+00 |
| 4 | 2 | .32632E+00 | -.14586E+01 | .67881E-01 | -.39586E-01 | .18428E+01 | -.67280E-01 | -.21022E+00 | .97534E+00 |
| 5 | 2 | .32287E+00 | -.14025E+01 | .10152E+00 | .34050E-01 | .18450E+01 | -.10096E+00 | -.20363E+00 | .97383E+00 |
| 6 | 2 | .31934E+00 | -.13464E+01 | .13508E+00 | .71027E-01 | .18407E+01 | -.13445E+00 | -.19659E+00 | .97122E+00 |
| 7 | 2 | .31599E+00 | -.12903E+01 | .16823E+00 | .90173E-01 | .18282E+01 | -.16753E+00 | -.18955E+00 | .96747E+00 |
| 8 | 2 | .31311E+00 | -.12342E+01 | .20070E+00 | .97679E-01 | .18059E+01 | -.19996E+00 | -.18304E+00 | .96256E+00 |
| 9 | 2 | .31093E+00 | -.11781E+01 | .23227E+00 | .96692E-01 | .17722E+01 | -.23148E+00 | -.17755E+00 | .95650E+00 |
| 10 | 2 | .30958E+00 | -.11220E+01 | .26277E+00 | .89595E-01 | .17269E+01 | -.26184E+00 | -.17342E+00 | .94940E+00 |
| 11 | 2 | .30889E+00 | -.10659E+01 | .29215E+00 | .79487E-01 | .16713E+01 | -.29090E+00 | -.17041E+00 | .94146E+00 |
| 12 | 2 | .30876E+00 | -.10098E+01 | .32034E+00 | .68000E-01 | .16068E+01 | -.31854E+00 | -.16837E+00 | .93283E+00 |
| 13 | 2 | .30913E+00 | -.95370E+00 | .34729E+00 | .55971E-01 | .15346E+01 | -.34465E+00 | -.16726E+00 | .92371E+00 |
| 14 | 2 | .30992E+00 | -.89760E+00 | .37295E+00 | .44056E-01 | .14559E+01 | -.36915E+00 | -.16700E+00 | .91424E+00 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 2 | .31102E+00 | -.84150E+00 | .39726E+00 | .32750E-01 | .13719E+01 | -.39196E+00 | -.16748E+00 | .90461E+00 |
| 16 | 2 | .31236E+00 | -.78540E+00 | .42019E+00 | .22401E-01 | .12840E+01 | -.41308E+00 | -.16856E+00 | .89496E+00 |
| 17 | 2 | .31376E+00 | -.72930E+00 | .44169E+00 | .13402E-01 | .11934E+01 | -.43252E+00 | -.16991E+00 | .88547E+00 |
| 18 | 2 | .31513E+00 | -.67320E+00 | .46172E+00 | .58178E-02 | .11011E+01 | -.45034E+00 | -.17135E+00 | .87626E+00 |
| 19 | 2 | .31643E+00 | -.61710E+00 | .48023E+00 | -.45849E-03 | .10075E+01 | -.46654E+00 | -.17276E+00 | .86747E+00 |
| 20 | 2 | .31765E+00 | -.56100E+00 | .49717E+00 | -.56375E-02 | .91293E+00 | -.48114E+00 | -.17418E+00 | .85917E+00 |
| 21 | 2 | .31884E+00 | -.50490E+00 | .51252E+00 | -.99438E-02 | .81758E+00 | -.49408E+00 | -.17580E+00 | .85146E+00 |
| 22 | 2 | .32005E+00 | -.44880E+00 | .52622E+00 | -.13566E-01 | .72156E+00 | -.50529E+00 | -.17797E+00 | .84440E+00 |
| 23 | 2 | .32151E+00 | -.39270E+00 | .53826E+00 | -.16825E-01 | .62469E+00 | -.51434E+00 | -.18202E+00 | .83805E+00 |
| 24 | 2 | .32357E+00 | -.33660E+00 | .54862E+00 | -.19970E-01 | .52693E+00 | -.52023E+00 | -.19083E+00 | .83244E+00 |
| 25 | 2 | .32623E+00 | -.28050E+00 | .55730E+00 | -.22701E-01 | .42928E+00 | -.52157E+00 | -.20730E+00 | .82764E+00 |
| 26 | 2 | .32948E+00 | -.22440E+00 | .56433E+00 | -.24708E-01 | .33308E+00 | -.51507E+00 | -.23699E+00 | .82373E+00 |
| 27 | 2 | .33327E+00 | -.16830E+00 | .56974E+00 | -.25711E-01 | .24045E+00 | -.49087E+00 | -.29223E+00 | .82076E+00 |
| 28 | 2 | .33743E+00 | -.11220E+00 | .57352E+00 | -.25427E-01 | .15624E+00 | -.41163E+00 | -.40022E+00 | .81877E+00 |
| 29 | 2 | .34073E+00 | -.56100E-01 | .57562E+00 | -.23593E-01 | .94154E-01 | -.13029E+00 | -.56048E+00 | .81785E+00 |
| 30 | 2 | .34375E+00 | -.71054E-14 | .57604E+00 | -.20627E-01 | .99749E-01 | .38659E+00 | -.42600E+00 | .81796E+00 |
| 31 | 2 | .34751E+00 | .56100E-01 | .57489E+00 | -.16438E-01 | .16534E+00 | .53533E+00 | -.20632E+00 | .81906E+00 |
| 32 | 2 | .34902E+00 | .11220E+00 | .57183E+00 | -.11807E-01 | .24009E+00 | .56409E+00 | -.86176E-01 | .82121E+00 |
| 33 | 2 | .34990E+00 | .16830E+00 | .56704E+00 | -.69089E-02 | .31887E+00 | .56585E+00 | -.18745E-01 | .82429E+00 |
| 34 | 2 | .35064E+00 | .22440E+00 | .56056E+00 | -.16665E-02 | .39910E+00 | .55990E+00 | .22197E-01 | .82827E+00 |
| 35 | 2 | .35132E+00 | .28050E+00 | .55243E+00 | .39601E-02 | .47944E+00 | .55095E+00 | .49252E-01 | .83308E+00 |
| 36 | 2 | .35191E+00 | .33660E+00 | .54267E+00 | .99505E-02 | .55922E+00 | .54027E+00 | .68589E-01 | .83869E+00 |
| 37 | 2 | .35233E+00 | .39270E+00 | .53128E+00 | .16217E-01 | .63813E+00 | .52817E+00 | .83470E-01 | .84503E+00 |
| 38 | 2 | .35268E+00 | .44880E+00 | .51831E+00 | .22866E-01 | .71587E+00 | .51478E+00 | .95098E-01 | .85203E+00 |
| 39 | 2 | .35328E+00 | .50490E+00 | .50383E+00 | .30418E-01 | .79175E+00 | .50028E+00 | .10354E+00 | .85965E+00 |
| 40 | 2 | .35410E+00 | .56100E+00 | .48790E+00 | .39078E-01 | .86535E+00 | .48461E+00 | .10970E+00 | .86782E+00 |
| 41 | 2 | .35512E+00 | .61710E+00 | .47055E+00 | .49032E-01 | .93633E+00 | .46772E+00 | .11424E+00 | .87646E+00 |
| 42 | 2 | .35629E+00 | .67320E+00 | .45182E+00 | .60445E-01 | .10045E+01 | .44955E+00 | .11763E+00 | .88548E+00 |
| 43 | 2 | .35754E+00 | .72930E+00 | .43177E+00 | .73479E-01 | .10696E+01 | .43004E+00 | .12023E+00 | .89477E+00 |
| 44 | 2 | .35882E+00 | .78540E+00 | .41045E+00 | .88278E-01 | .11315E+01 | .40918E+00 | .12232E+00 | .90422E+00 |
| 45 | 2 | .35996E+00 | .84150E+00 | .38788E+00 | .10472E+00 | .11905E+01 | .38691E+00 | .12430E+00 | .91370E+00 |
| 46 | 2 | .36083E+00 | .89760E+00 | .36411E+00 | .12263E+00 | .12469E+01 | .36323E+00 | .12646E+00 | .92308E+00 |
| 47 | 2 | .36129E+00 | .95370E+00 | .33915E+00 | .14182E+00 | .13007E+01 | .33816E+00 | .12901E+00 | .93221E+00 |
| 48 | 2 | .36125E+00 | .10098E+01 | .31305E+00 | .16203E+00 | .13524E+01 | .31174E+00 | .13211E+00 | .94094E+00 |
| 49 | 2 | .36061E+00 | .10659E+01 | .28584E+00 | .18300E+00 | .14021E+01 | .28406E+00 | .13589E+00 | .94913E+00 |
| 50 | 2 | .35931E+00 | .11220E+01 | .25755E+00 | .20450E+00 | .14501E+01 | .25520E+00 | .14041E+00 | .95664E+00 |
| 51 | 2 | .35718E+00 | .11781E+01 | .22820E+00 | .22548E+00 | .14970E+01 | .22526E+00 | .14595E+00 | .96331E+00 |
| 52 | 2 | .35417E+00 | .12342E+01 | .19780E+00 | .24506E+00 | .15431E+01 | .19437E+00 | .15259E+00 | .96899E+00 |
| 53 | 2 | .35051E+00 | .12903E+01 | .16651E+00 | .26416E+00 | .15877E+01 | .16273E+00 | .15997E+00 | .97362E+00 |
| 54 | 2 | .34648E+00 | .13464E+01 | .13455E+00 | .28569E+00 | .16297E+01 | .13056E+00 | .16763E+00 | .97717E+00 |
| 55 | 2 | .34240E+00 | .14025E+01 | .10219E+00 | .31698E+00 | .16674E+01 | .98036E-01 | .17511E+00 | .97966E+00 |
| 56 | 2 | .33853E+00 | .14586E+01 | .69789E-01 | .37816E+00 | .16995E+01 | .65345E-01 | .18203E+00 | .98112E+00 |
| 57 | 2 | .33500E+00 | .15147E+01 | .38093E-01 | .55085E+00 | .17250E+01 | .32625E-01 | .18823E+00 | .98158E+00 |
| 58 | 2 | .33162E+00 | .15708E+01 | .14155E-01 | .15708E+01 | .17444E+01 | .11382E-13 | .19405E+00 | .98099E+00 |

SURFACE ARC LENGTH (S) SLOPE (THETA) AND CURVATURE (PSI)

| I | X/Z | Y/Z | S | THETA | PSI | (X/Z)/XMAX | (Y/Z)/XMAX | DYBP/DZP |
|---|---|---|---|---|---|---|---|---|
| 1 | -.00000 | -.01416 | 0.00000 | 9.27993 | .11194 | -.00000 | -.02180 | -.22360 |
| 2 | .03398 | -.00851 | .03445 | 9.57893 | .18181 | .05233 | -.01311 | -.22369 |
| 3 | .06793 | -.00269 | .06889 | 10.01198 | .18969 | .10461 | -.00414 | -.22412 |
| 4 | .10181 | .00347 | .10332 | 10.33667 | -.01695 | .15678 | .00534 | -.22454 |
| 5 | .13556 | .00964 | .13764 | 9.94767 | -.38189 | .20876 | .01485 | -.22357 |
| 6 | .16915 | .01529 | .17170 | 8.59966 | -.87694 | .26047 | .02355 | -.21973 |
| 7 | .20247 | .01984 | .20533 | 6.32239 | -1.33307 | .31179 | .03055 | -.21203 |
| 8 | .23543 | .02284 | .23843 | 3.33591 | -1.41768 | .36255 | .03517 | -.20033 |
| 9 | .26791 | .02407 | .27094 | .90658 | -1.15692 | .41257 | .03706 | -.18961 |
| 10 | .29981 | .02388 | .30284 | -1.03859 | -1.13566 | .46168 | .03678 | -.18012 |
| 11 | .33100 | .02254 | .33406 | -3.25098 | -1.09565 | .50972 | .03471 | -.16810 |
| 12 | .36140 | .02025 | .36455 | -5.02297 | -.89996 | .55653 | .03118 | -.15743 |
| 13 | .39088 | .01723 | .39418 | -6.39887 | -.69636 | .60192 | .02654 | -.14837 |
| 14 | .41934 | .01374 | .42286 | -7.37860 | -.43487 | .64576 | .02116 | -.14140 |
| 15 | .44668 | .01001 | .45045 | -7.88701 | -.13290 | .68786 | .01541 | -.13755 |
| 16 | .47280 | .00634 | .47683 | -7.95343 | .04217 | .72808 | .00976 | -.13705 |
| 17 | .49758 | .00289 | .50184 | -7.77588 | .15421 | .76623 | .00446 | -.13860 |
| 18 | .52090 | -.00024 | .52537 | -7.51854 | .17980 | .80214 | -.00037 | -.14093 |
| 19 | .54263 | -.00306 | .54728 | -7.30492 | .12491 | .83561 | -.00471 | -.14294 |
| 20 | .56264 | -.00559 | .56745 | -7.19540 | -.05963 | .86642 | -.00862 | -.14400 |
| 21 | .58080 | -.00788 | .58576 | -7.40480 | -.44954 | .89438 | -.01213 | -.14184 |
| 22 | .59698 | -.01005 | .60209 | -8.18029 | -.91588 | .91931 | -.01547 | -.13367 |
| 23 | .61108 | -.01221 | .61635 | -8.98144 | -.52492 | .94102 | -.01879 | -.12506 |
| 24 | .62304 | -.01415 | .62846 | -8.92193 | .59714 | .95943 | -.02178 | -.12578 |
| 25 | .63281 | -.01564 | .63835 | -7.19999 | 4.81384 | .97448 | -.02408 | -.14514 |
| 26 | .64038 | -.01647 | .64597 | -2.30565 | 17.08161 | .98614 | -.02536 | -.20012 |
| 27 | .64574 | -.01642 | .65135 | 8.01381 | 69.38116 | .99439 | -.02529 | -.31677 |
| 28 | .64875 | -.01531 | .65464 | 51.46930 | 278.73204 | .99902 | -.02357 | -1.03944 |
| 29 | .64938 | -.01340 | .65670 | 90.10833 | 264.31107 | 1.00000 | -.02063 | 343.34222 |
| 30 | .64779 | -.01065 | .65995 | 129.25381 | 104.66419 | .99755 | -.01640 | .57267 |
| 31 | .64351 | -.00760 | .66524 | 149.03810 | 29.50386 | .99096 | -.01170 | .16904 |
| 32 | .63678 | -.00440 | .67271 | 156.95057 | 10.76401 | .98059 | -.00677 | .05711 |
| 33 | .62773 | -.00105 | .68236 | 161.15812 | 5.31823 | .96665 | -.00161 | .00372 |
| 34 | .61645 | .00244 | .69417 | 163.93357 | 3.29739 | .94928 | .00376 | -.02946 |
| 35 | .60303 | .00600 | .70805 | 166.12317 | 2.24793 | .92862 | .00924 | -.05446 |
| 36 | .58756 | .00953 | .72392 | 167.85510 | 1.24980 | .90479 | .01467 | -.07347 |
| 37 | .57017 | .01304 | .74166 | 168.77447 | .53431 | .87801 | .02008 | -.08324 |
| 38 | .55104 | .01677 | .76116 | 169.07257 | .19578 | .84855 | .02582 | -.08629 |
| 39 | .53029 | .02073 | .78228 | 169.24399 | .12962 | .81660 | .03193 | -.08797 |
| 40 | .50804 | .02493 | .80492 | 169.39714 | .13279 | .78235 | .03839 | -.08940 |
| 41 | .48442 | .02932 | .82894 | 169.60480 | .18025 | .74597 | .04514 | -.09126 |
| 42 | .45953 | .03383 | .85424 | 169.92175 | .28856 | .70763 | .05209 | -.09394 |
| 43 | .43347 | .03837 | .88069 | 170.51090 | .49388 | .66751 | .05908 | -.09862 |
| 44 | .40635 | .04271 | .90816 | 171.50808 | .73557 | .62574 | .06577 | -.10606 |
| 45 | .37824 | .04662 | .93654 | 172.88719 | .93383 | .58246 | .07179 | -.11562 |
| 46 | .34924 | .04986 | .96572 | 174.62837 | 1.11433 | .53781 | .07678 | -.12674 |
| 47 | .31946 | .05222 | .99560 | 176.73171 | 1.32169 | .49194 | .08041 | -.13898 |
| 48 | .28898 | .05348 | 1.02611 | 179.26369 | 1.30579 | .44500 | .08236 | -.15224 |
| 49 | .25792 | .05349 | 1.05717 | 181.40207 | 1.31191 | .39717 | .08237 | -.16226 |
| 50 | .22636 | .05192 | 1.08877 | 184.06729 | 1.53015 | .34858 | .07996 | -.17361 |
| 51 | .19443 | .04862 | 1.12087 | 187.00510 | 1.32168 | .29940 | .07488 | -.18471 |
| 52 | .16224 | .04388 | 1.15342 | 189.16568 | .84763 | .24983 | .06757 | -.19174 |
| 53 | .12988 | .03815 | 1.18627 | 190.41072 | .36172 | .20001 | .05875 | -.19515 |

| I | X/Z | Y/Z | S | THETA | PSI | (X/Z)/XMAX | (Y/Z)/XMAX | DYBP/DZP |
|---|---|---|---|---|---|---|---|---|
| 54 | .09744 | .03197 | 1.21930 | 190.76273 | .01733 | .15005 | .04922 | -.19600 |
| 55 | .06496 | .02581 | 1.25235 | 190.47562 | -.15674 | .10004 | .03974 | -.19564 |
| 56 | .03247 | .01995 | 1.28537 | 190.16898 | -.09873 | .05001 | .03072 | -.19532 |
| 57 | .00000 | .01416 | 1.31836 | 190.05525 | -.00923 | .00000 | .02180 | -.19528 |

SMAX= 1.31836 XMAX= .64938 SMAX/XMAX= 2.03016

SLOR SOLUTION ITERATION BEGINS ON MESH 2

| ITER | DELMX | I | J | DELAVG | RESMX | I | J | RESAVG | KSUP | NPVD | JSHMAX | ISHMAX | JSHMIN | ISHMIN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .5191E-03 | 55 | 2 | .1753E-04 | -.1648E+01 | 7 | 2 | .7925E-01 | 1172 | 0 | 56 | 0 | 0 | 0 |
| 2 | -.3030E-03 | 2 | 2 | .8217E-05 | -.7385E+00 | 2 | 2 | .3422E-01 | 1173 | 0 | 56 | 0 | 0 | 0 |
| 3 | .1176E-03 | 57 | 2 | .5031E-05 | -.4381E+00 | 32 | 2 | .2020E-01 | 1175 | 0 | 56 | 0 | 0 | 0 |
| 4 | -.8528E-04 | 32 | 2 | .3834E-05 | -.4112E+00 | 33 | 6 | .1471E-01 | 1174 | 0 | 56 | 0 | 0 | 0 |
| 5 | -.7080E-04 | 33 | 2 | .3190E-05 | -.4087E+00 | 33 | 6 | .1194E-01 | 1173 | 0 | 56 | 0 | 0 | 0 |
| 6 | -.6851E-04 | 21 | 38 | .2953E-05 | -.3937E+00 | 33 | 6 | .1061E-01 | 1173 | 0 | 56 | 0 | 0 | 0 |
| 7 | -.6931E-04 | 21 | 38 | .2735E-05 | -.3721E+00 | 33 | 6 | .9609E-02 | 1173 | 0 | 56 | 0 | 0 | 0 |
| 8 | -.5709E-04 | 21 | 38 | .2632E-05 | -.3477E+00 | 33 | 6 | .8986E-02 | 1171 | 0 | 56 | 0 | 0 | 0 |
| 9 | -.7074E-04 | 22 | 38 | .2567E-05 | -.3215E+00 | 33 | 6 | .8525E-02 | 1171 | 0 | 56 | 0 | 0 | 0 |
| 10 | -.5741E-04 | 22 | 38 | .2468E-05 | -.2953E+00 | 33 | 6 | .8088E-02 | 1172 | 0 | 56 | 0 | 0 | 0 |
| 11 | -.3977E-04 | 35 | 2 | .2353E-05 | -.2709E+00 | 33 | 6 | .7682E-02 | 1172 | 0 | 56 | 0 | 0 | 0 |
| 12 | -.3987E-04 | 35 | 2 | .2279E-05 | -.2479E+00 | 33 | 6 | .7384E-02 | 1171 | 0 | 56 | 0 | 0 | 0 |
| 13 | -.3910E-04 | 35 | 2 | .2247E-05 | -.2270E+00 | 33 | 6 | .7180E-02 | 1171 | 0 | 56 | 0 | 0 | 0 |
| 14 | -.3778E-04 | 35 | 2 | .2220E-05 | -.2081E+00 | 33 | 6 | .7016E-02 | 1171 | 0 | 56 | 0 | 0 | 0 |
| 15 | -.3614E-04 | 35 | 2 | .2184E-05 | -.1920E+00 | 33 | 7 | .6863E-02 | 1171 | 0 | 56 | 0 | 0 | 0 |
| 16 | -.3611E-04 | 36 | 2 | .2150E-05 | -.1787E+00 | 33 | 7 | .6721E-02 | 1170 | 0 | 56 | 0 | 0 | 0 |
| 17 | -.3596E-04 | 36 | 2 | .2119E-05 | -.1664E+00 | 33 | 7 | .6596E-02 | 1170 | 0 | 56 | 0 | 0 | 0 |
| 18 | -.3542E-04 | 36 | 2 | .2094E-05 | -.1596E+00 | 35 | 6 | .6491E-02 | 1170 | 0 | 56 | 0 | 0 | 0 |
| 19 | -.3462E-04 | 36 | 2 | .2073E-05 | -.1539E+00 | 35 | 6 | .6403E-02 | 1170 | 0 | 56 | 0 | 0 | 0 |
| 20 | -.3365E-04 | 36 | 2 | .2060E-05 | -.1482E+00 | 35 | 6 | .6336E-02 | 1169 | 0 | 56 | 0 | 0 | 0 |
| 21 | -.3257E-04 | 36 | 2 | .2052E-05 | -.1426E+00 | 35 | 6 | .6285E-02 | 1169 | 0 | 56 | 0 | 0 | 0 |
| 22 | -.3253E-04 | 37 | 2 | .2043E-05 | -.1370E+00 | 35 | 6 | .6240E-02 | 1169 | 0 | 56 | 0 | 0 | 0 |
| 23 | -.3227E-04 | 37 | 2 | .2033E-05 | -.1316E+00 | 35 | 6 | .6193E-02 | 1169 | 0 | 56 | 0 | 0 | 0 |
| 24 | -.3185E-04 | 37 | 2 | .2023E-05 | -.1264E+00 | 35 | 6 | .6150E-02 | 1169 | 0 | 56 | 0 | 0 | 0 |
| 25 | -.3129E-04 | 37 | 2 | .2010E-05 | -.1214E+00 | 35 | 6 | .6110E-02 | 1169 | 0 | 56 | 0 | 0 | 0 |
| 26 | -.3064E-04 | 37 | 2 | .1995E-05 | -.1165E+00 | 35 | 6 | .6066E-02 | 1169 | 0 | 56 | 0 | 0 | 0 |
| 27 | -.2993E-04 | 37 | 2 | .1978E-05 | -.1119E+00 | 35 | 6 | .6020E-02 | 1169 | 0 | 56 | 0 | 0 | 0 |
| 28 | -.2917E-04 | 37 | 2 | .1961E-05 | -.1083E+00 | 37 | 4 | .5972E-02 | 1169 | 0 | 56 | 0 | 0 | 0 |
| 29 | -.2873E-04 | 38 | 2 | .1944E-05 | -.1055E+00 | 37 | 4 | .5926E-02 | 1169 | 0 | 56 | 0 | 0 | 0 |
| 30 | -.2850E-04 | 38 | 2 | .1926E-05 | -.1027E+00 | 37 | 4 | .5876E-02 | 1168 | 0 | 56 | 0 | 0 | 0 |
| 31 | -.2819E-04 | 38 | 2 | .1912E-05 | -.9977E-01 | 37 | 4 | .5833E-02 | 1168 | 0 | 56 | 0 | 0 | 0 |
| 32 | -.2780E-04 | 38 | 2 | .1898E-05 | -.9683E-01 | 37 | 4 | .5794E-02 | 1168 | 0 | 56 | 0 | 0 | 0 |
| 33 | -.2736E-04 | 38 | 2 | .1883E-05 | -.9500E-01 | 38 | 4 | .5754E-02 | 1167 | 0 | 56 | 0 | 0 | 0 |
| 34 | -.2686E-04 | 38 | 2 | .1870E-05 | -.9367E-01 | 38 | 5 | .5717E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 35 | -.2634E-04 | 38 | 2 | .1860E-05 | -.9227E-01 | 38 | 5 | .5684E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 36 | -.2579E-04 | 38 | 2 | .1850E-05 | -.9076E-01 | 38 | 5 | .5651E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 37 | -.2523E-04 | 38 | 2 | .1840E-05 | -.8915E-01 | 38 | 5 | .5618E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 38 | -.2495E-04 | 39 | 2 | .1831E-05 | -.8748E-01 | 38 | 5 | .5584E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 39 | -.2473E-04 | 39 | 2 | .1822E-05 | -.8575E-01 | 38 | 5 | .5551E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 40 | -.2447E-04 | 39 | 2 | .1815E-05 | -.8398E-01 | 38 | 5 | .5521E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 41 | -.2417E-04 | 39 | 2 | .1805E-05 | -.8219E-01 | 38 | 5 | .5487E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | -.2384E-04 | 39 | 2 | .1794E-05 | -.8039E-01 | 38 | 5 | .5454E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 43 | -.2348E-04 | 39 | 2 | .1784E-05 | -.7881E-01 | 39 | 5 | .5421E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 44 | -.2310E-04 | 39 | 2 | .1774E-05 | -.7775E-01 | 39 | 5 | .5387E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 45 | -.2270E-04 | 39 | 2 | .1763E-05 | -.7662E-01 | 39 | 5 | .5352E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 46 | -.2229E-04 | 39 | 2 | .1754E-05 | -.7543E-01 | 39 | 5 | .5317E-02 | 1166 | 0 | 56 | 0 | 0 | 0 |
| 47 | -.2187E-04 | 39 | 2 | .1745E-05 | -.7419E-01 | 39 | 5 | .5281E-02 | 1167 | 0 | 56 | 0 | 0 | 0 |
| 48 | -.2159E-04 | 40 | 2 | .1737E-05 | -.7291E-01 | 39 | 5 | .5247E-02 | 1167 | 0 | 56 | 0 | 0 | 0 |
| 49 | -.2140E-04 | 40 | 2 | .1730E-05 | -.7161E-01 | 39 | 5 | .5214E-02 | 1167 | 0 | 56 | 0 | 0 | 0 |
| 50 | -.2119E-04 | 40 | 2 | .1724E-05 | -.7028E-01 | 39 | 5 | .5182E-02 | 1168 | 0 | 40 | 2 | 38 | 26 |
| 51 | .2146E-04 | 26 | 37 | .2566E-05 | .9210E-01 | 33 | 37 | .7341E-02 | 370 | 0 | 40 | 2 | 38 | 26 |
| 52 | -.2052E-04 | 40 | 2 | .2359E-05 | .8717E-01 | 33 | 37 | .7069E-02 | 370 | 0 | 40 | 2 | 38 | 26 |
| 53 | -.2020E-04 | 40 | 2 | .2255E-05 | .8296E-01 | 33 | 37 | .6930E-02 | 371 | 0 | 40 | 2 | 38 | 26 |
| 54 | -.1987E-04 | 40 | 2 | .2190E-05 | .7937E-01 | 33 | 37 | .6836E-02 | 371 | 0 | 40 | 2 | 38 | 26 |
| 55 | .2846E-04 | 14 | 39 | .2257E-05 | .1025E+00 | 15 | 38 | .6834E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 56 | .2243E-04 | 14 | 39 | .2169E-05 | .8772E-01 | 15 | 38 | .6703E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 57 | -.1888E-04 | 40 | 2 | .2110E-05 | .7539E-01 | 15 | 38 | .6616E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 58 | -.1855E-04 | 40 | 2 | .2067E-05 | .6979E-01 | 33 | 37 | .6550E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 59 | -.1822E-04 | 40 | 2 | .2035E-05 | .6828E-01 | 33 | 37 | .6494E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 60 | -.1800E-04 | 41 | 2 | .2011E-05 | .6703E-01 | 33 | 37 | .6444E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 61 | -.1783E-04 | 41 | 2 | .1991E-05 | .6600E-01 | 33 | 37 | .6399E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 62 | -.1764E-04 | 41 | 2 | .1976E-05 | .6516E-01 | 33 | 37 | .6357E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 63 | -.1743E-04 | 41 | 2 | .1963E-05 | .6447E-01 | 33 | 37 | .6317E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 64 | -.1722E-04 | 41 | 2 | .1952E-05 | .6392E-01 | 33 | 37 | .6278E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 65 | -.1699E-04 | 41 | 2 | .1943E-05 | .6348E-01 | 33 | 37 | .6241E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 66 | -.1675E-04 | 41 | 2 | .1935E-05 | .6314E-01 | 33 | 37 | .6205E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 67 | -.1651E-04 | 41 | 2 | .1929E-05 | .6287E-01 | 33 | 37 | .6170E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 68 | -.1626E-04 | 41 | 2 | .1924E-05 | .6267E-01 | 33 | 37 | .6134E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 69 | -.1600E-04 | 41 | 2 | .1919E-05 | .6252E-01 | 33 | 37 | .6100E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 70 | -.1574E-04 | 41 | 2 | .1914E-05 | .6241E-01 | 33 | 37 | .6065E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 71 | -.1548E-04 | 41 | 2 | .1910E-05 | .6234E-01 | 33 | 37 | .6031E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 72 | -.1522E-04 | 41 | 2 | .1906E-05 | .6230E-01 | 33 | 37 | .5998E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 73 | -.1495E-04 | 41 | 2 | .1902E-05 | .6229E-01 | 33 | 37 | .5964E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 74 | -.1469E-04 | 42 | 2 | .1899E-05 | .6229E-01 | 33 | 37 | .5931E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 75 | -.1454E-04 | 42 | 2 | .1895E-05 | .6231E-01 | 33 | 37 | .5897E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 76 | -.1438E-04 | 42 | 2 | .1891E-05 | .6235E-01 | 33 | 37 | .5864E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 77 | -.1421E-04 | 42 | 2 | .1887E-05 | .6239E-01 | 33 | 37 | .5830E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 78 | -.1404E-04 | 42 | 2 | .1883E-05 | .6244E-01 | 33 | 37 | .5797E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 79 | -.1386E-04 | 42 | 2 | .1879E-05 | .6250E-01 | 33 | 37 | .5764E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 80 | -.1368E-04 | 42 | 2 | .1875E-05 | .6257E-01 | 33 | 37 | .5731E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 81 | -.1349E-04 | 42 | 2 | .1871E-05 | .6263E-01 | 33 | 37 | .5697E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 82 | -.1331E-04 | 42 | 2 | .1866E-05 | .6270E-01 | 33 | 37 | .5665E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 83 | -.1312E-04 | 42 | 2 | .1862E-05 | .6277E-01 | 33 | 37 | .5632E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 84 | -.1292E-04 | 42 | 2 | .1857E-05 | .6285E-01 | 33 | 37 | .5600E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 85 | -.1273E-04 | 42 | 2 | .1853E-05 | .6292E-01 | 33 | 37 | .5567E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 86 | -.1254E-04 | 42 | 2 | .1848E-05 | .6299E-01 | 33 | 37 | .5535E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 87 | -.1234E-04 | 42 | 2 | .1843E-05 | .6306E-01 | 33 | 37 | .5504E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 88 | -.1215E-04 | 42 | 2 | .1838E-05 | .6314E-01 | 33 | 37 | .5472E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 89 | -.1195E-04 | 42 | 2 | .1832E-05 | .6321E-01 | 33 | 37 | .5441E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 90 | -.1176E-04 | 42 | 2 | .1827E-05 | .6328E-01 | 33 | 37 | .5409E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 91 | -.1157E-04 | 42 | 2 | .1821E-05 | .6334E-01 | 33 | 37 | .5379E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 92 | -.1138E-04 | 42 | 2 | .1816E-05 | .6341E-01 | 33 | 37 | .5348E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 93 | -.1119E-04 | 42 | 2 | .1810E-05 | .6347E-01 | 33 | 37 | .5318E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 94 | -.1100E-04 | 42 | 2 | .1804E-05 | .6354E-01 | 33 | 37 | .5288E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 95 | -.1081E-04 | 42 | 2 | .1798E-05 | .6360E-01 | 33 | 37 | .5258E-02 | 373 | 0 | 40 | 2 | 38 | 26 |
| 96 | -.1063E-04 | 42 | 2 | .1792E-05 | .6366E-01 | 33 | 37 | .5228E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 97 | -.1046E-04 | 43 | 2 | .1786E-05 | .6372E-01 | 33 | 37 | .5199E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 98 | -.1033E-04 | 43 | 2 | .1780E-05 | .6377E-01 | 33 | 37 | .5170E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 99 | -.1020E-04 | 43 | 2 | .1774E-05 | .6383E-01 | 33 | 37 | .5140E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 100 | -.1007E-04 | 43 | 2 | .1767E-05 | .6388E-01 | 33 | 37 | .5112E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 101 | -.9937E-05 | 43 | 2 | .1761E-05 | .6393E-01 | 33 | 37 | .5083E-02 | 374 | 0 | 40 | 2 | 38 | 26 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 102 | -.9805E-05 | 43 | 2 | .1754E-05 | .6398E-01 | 33 | 37 | .5055E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 103 | -.9671E-05 | 43 | 2 | .1747E-05 | .6402E-01 | 33 | 37 | .5027E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 104 | -.9537E-05 | 43 | 2 | .1741E-05 | .6407E-01 | 33 | 37 | .4999E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 105 | -.9403E-05 | 43 | 2 | .1734E-05 | .6411E-01 | 33 | 37 | .4971E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 106 | -.9269E-05 | 43 | 2 | .1727E-05 | .6415E-01 | 33 | 37 | .4943E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 107 | -.9135E-05 | 43 | 2 | .1720E-05 | .6419E-01 | 33 | 37 | .4916E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 108 | -.9002E-05 | 43 | 2 | .1713E-05 | .6423E-01 | 33 | 37 | .4888E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 109 | -.8869E-05 | 43 | 2 | .1706E-05 | .6427E-01 | 33 | 37 | .4861E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 110 | -.8737E-05 | 43 | 2 | .1699E-05 | .6431E-01 | 33 | 37 | .4835E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 111 | -.8606E-05 | 43 | 2 | .1692E-05 | .6434E-01 | 33 | 37 | .4808E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 112 | -.8475E-05 | 43 | 2 | .1684E-05 | .6438E-01 | 33 | 37 | .4781E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 113 | -.8346E-05 | 43 | 2 | .1677E-05 | .6441E-01 | 33 | 37 | .4755E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 114 | -.8217E-05 | 43 | 2 | .1670E-05 | .6444E-01 | 33 | 37 | .4729E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 115 | -.8090E-05 | 43 | 2 | .1663E-05 | .6448E-01 | 33 | 37 | .4703E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 116 | -.7964E-05 | 43 | 2 | .1655E-05 | .6451E-01 | 33 | 37 | .4677E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 117 | -.7839E-05 | 43 | 2 | .1648E-05 | .6453E-01 | 33 | 37 | .4652E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 118 | -.7716E-05 | 43 | 2 | .1641E-05 | .6456E-01 | 33 | 37 | .4626E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 119 | -.7594E-05 | 43 | 2 | .1633E-05 | .6459E-01 | 33 | 37 | .4601E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 120 | -.7474E-05 | 43 | 2 | .1626E-05 | .6462E-01 | 33 | 37 | .4576E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
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| 122 | -.7237E-05 | 43 | 2 | .1611E-05 | .6467E-01 | 33 | 37 | .4526E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 123 | -.7121E-05 | 43 | 2 | .1603E-05 | .6470E-01 | 33 | 37 | .4502E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 124 | -.7007E-05 | 43 | 2 | .1596E-05 | .6472E-01 | 33 | 37 | .4478E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 125 | -.6894E-05 | 43 | 2 | .1588E-05 | .6474E-01 | 33 | 37 | .4454E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 126 | -.6783E-05 | 43 | 2 | .1581E-05 | .6477E-01 | 33 | 37 | .4430E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
| 127 | -.6674E-05 | 43 | 2 | .1573E-05 | .6479E-01 | 33 | 37 | .4406E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
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| 129 | -.6460E-05 | 43 | 2 | .1558E-05 | .6484E-01 | 33 | 37 | .4359E-02 | 375 | 0 | 40 | 2 | 38 | 26 |
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| 133 | -.6048E-05 | 43 | 2 | .1527E-05 | .6492E-01 | 33 | 37 | .4266E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 134 | -.5949E-05 | 43 | 2 | .1519E-05 | .6495E-01 | 33 | 37 | .4243E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
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| 141 | -.5304E-05 | 43 | 2 | .1466E-05 | .6509E-01 | 33 | 37 | .4089E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 142 | -.5219E-05 | 43 | 2 | .1458E-05 | .6511E-01 | 33 | 37 | .4067E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 143 | -.5135E-05 | 43 | 2 | .1450E-05 | .6514E-01 | 33 | 37 | .4046E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 144 | -.5052E-05 | 43 | 2 | .1443E-05 | .6516E-01 | 33 | 37 | .4024E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 145 | -.4971E-05 | 43 | 2 | .1435E-05 | .6518E-01 | 33 | 37 | .4003E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 146 | -.4892E-05 | 43 | 2 | .1427E-05 | .6520E-01 | 33 | 37 | .3982E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 147 | -.4814E-05 | 43 | 2 | .1420E-05 | .6522E-01 | 33 | 37 | .3961E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 148 | -.4738E-05 | 43 | 2 | .1412E-05 | .6524E-01 | 33 | 37 | .3940E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 149 | -.4663E-05 | 43 | 2 | .1404E-05 | .6526E-01 | 33 | 37 | .3919E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 150 | -.4589E-05 | 43 | 2 | .1397E-05 | .6528E-01 | 33 | 37 | .3899E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 151 | -.4517E-05 | 43 | 2 | .1389E-05 | .6530E-01 | 33 | 37 | .3878E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 152 | -.4446E-05 | 43 | 2 | .1382E-05 | .6533E-01 | 33 | 37 | .3858E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 153 | -.4376E-05 | 43 | 2 | .1374E-05 | .6535E-01 | 33 | 37 | .3837E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 154 | -.4308E-05 | 43 | 2 | .1366E-05 | .6537E-01 | 33 | 37 | .3817E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 155 | -.4241E-05 | 43 | 2 | .1359E-05 | .6539E-01 | 33 | 37 | .3797E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 156 | -.4176E-05 | 43 | 2 | .1351E-05 | .6541E-01 | 33 | 37 | .3777E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 157 | -.4111E-05 | 43 | 2 | .1344E-05 | .6543E-01 | 33 | 37 | .3757E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 158 | -.4048E-05 | 43 | 2 | .1336E-05 | .6546E-01 | 33 | 37 | .3737E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 159 | -.3986E-05 | 43 | 2 | .1329E-05 | .6548E-01 | 33 | 37 | .3718E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 160 | -.3925E-05 | 43 | 2 | .1321E-05 | .6550E-01 | 33 | 37 | .3698E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 161 | -.3865E-05 | 43 | 2 | .1314E-05 | .6552E-01 | 33 | 37 | .3679E-02 | 374 | 0 | 40 | 2 | 38 | 26 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 162 | -.3806E-05 | 43 | 2 | .1306E-05 | .6555E-01 | 33 | 37 | .3659E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 163 | -.3749E-05 | 43 | 2 | .1299E-05 | .6557E-01 | 33 | 37 | .3640E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 164 | -.3692E-05 | 43 | 2 | .1291E-05 | .6559E-01 | 33 | 37 | .3621E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 165 | -.3637E-05 | 43 | 2 | .1284E-05 | .6562E-01 | 33 | 37 | .3602E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 166 | -.3582E-05 | 43 | 2 | .1277E-05 | .6564E-01 | 33 | 37 | .3583E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 167 | -.3529E-05 | 43 | 2 | .1269E-05 | .6566E-01 | 33 | 37 | .3564E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 168 | -.3476E-05 | 43 | 2 | .1262E-05 | .6569E-01 | 33 | 37 | .3545E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 169 | -.3425E-05 | 43 | 2 | .1254E-05 | .6571E-01 | 33 | 37 | .3527E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 170 | -.3375E-05 | 43 | 2 | .1247E-05 | .6573E-01 | 33 | 37 | .3508E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 171 | -.3325E-05 | 43 | 2 | .1240E-05 | .6576E-01 | 33 | 37 | .3490E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 172 | -.3276E-05 | 43 | 2 | .1233E-05 | .6578E-01 | 33 | 37 | .3471E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 173 | -.3229E-05 | 43 | 2 | .1225E-05 | .6580E-01 | 33 | 37 | .3453E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 174 | -.3182E-05 | 43 | 2 | .1218E-05 | .6583E-01 | 33 | 37 | .3435E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 175 | -.3136E-05 | 43 | 2 | .1211E-05 | .6585E-01 | 33 | 37 | .3417E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 176 | -.3091E-05 | 43 | 2 | .1204E-05 | .6588E-01 | 33 | 37 | .3399E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 177 | -.3046E-05 | 43 | 2 | .1197E-05 | .6590E-01 | 33 | 37 | .3382E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 178 | -.3003E-05 | 43 | 2 | .1189E-05 | .6593E-01 | 33 | 37 | .3364E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 179 | -.2960E-05 | 43 | 2 | .1182E-05 | .6595E-01 | 33 | 37 | .3346E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 180 | -.2918E-05 | 43 | 2 | .1175E-05 | .6598E-01 | 33 | 37 | .3329E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 181 | -.2877E-05 | 43 | 2 | .1168E-05 | .6600E-01 | 33 | 37 | .3312E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 182 | -.2837E-05 | 43 | 2 | .1161E-05 | .6603E-01 | 33 | 37 | .3294E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 183 | -.2797E-05 | 43 | 2 | .1154E-05 | .6605E-01 | 33 | 37 | .3277E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 184 | -.2758E-05 | 43 | 2 | .1147E-05 | .6608E-01 | 33 | 37 | .3260E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 185 | -.2720E-05 | 43 | 2 | .1140E-05 | .6610E-01 | 33 | 37 | .3243E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 186 | -.2682E-05 | 43 | 2 | .1133E-05 | .6613E-01 | 33 | 37 | .3226E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 187 | -.2645E-05 | 43 | 2 | .1126E-05 | .6615E-01 | 33 | 37 | .3210E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 188 | -.2609E-05 | 43 | 2 | .1120E-05 | .6618E-01 | 33 | 37 | .3193E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 189 | -.2573E-05 | 43 | 2 | .1113E-05 | .6620E-01 | 33 | 37 | .3176E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 190 | -.2538E-05 | 43 | 2 | .1106E-05 | .6623E-01 | 33 | 37 | .3160E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 191 | -.2504E-05 | 43 | 2 | .1099E-05 | .6625E-01 | 33 | 37 | .3144E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 192 | -.2470E-05 | 43 | 2 | .1093E-05 | .6628E-01 | 33 | 37 | .3127E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 193 | -.2437E-05 | 43 | 2 | .1086E-05 | .6630E-01 | 33 | 37 | .3111E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 194 | -.2404E-05 | 43 | 2 | .1079E-05 | .6633E-01 | 33 | 37 | .3095E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 195 | -.2372E-05 | 43 | 2 | .1073E-05 | .6635E-01 | 33 | 37 | .3079E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 196 | -.2341E-05 | 43 | 2 | .1066E-05 | .6638E-01 | 33 | 37 | .3063E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 197 | -.2310E-05 | 43 | 2 | .1059E-05 | .6640E-01 | 33 | 37 | .3048E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 198 | -.2279E-05 | 43 | 2 | .1053E-05 | .6643E-01 | 33 | 37 | .3032E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 199 | -.2250E-05 | 43 | 2 | .1046E-05 | .6645E-01 | 33 | 37 | .3016E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 200 | -.2220E-05 | 43 | 2 | .1040E-05 | .6648E-01 | 33 | 37 | .3001E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 201 | -.2191E-05 | 43 | 2 | .1034E-05 | .6651E-01 | 33 | 37 | .2986E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 202 | -.2163E-05 | 43 | 2 | .1027E-05 | .6653E-01 | 33 | 37 | .2970E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 203 | -.2135E-05 | 43 | 2 | .1021E-05 | .6656E-01 | 33 | 37 | .2955E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 204 | -.2108E-05 | 43 | 2 | .1014E-05 | .6658E-01 | 33 | 37 | .2940E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 205 | -.2081E-05 | 43 | 2 | .1008E-05 | .6661E-01 | 33 | 37 | .2925E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 206 | -.2054E-05 | 43 | 2 | .1002E-05 | .6663E-01 | 33 | 37 | .2910E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 207 | -.2028E-05 | 43 | 2 | .9958E-06 | .6666E-01 | 33 | 37 | .2895E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 208 | -.2003E-05 | 43 | 2 | .9896E-06 | .6668E-01 | 33 | 37 | .2880E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 209 | -.1977E-05 | 43 | 2 | .9834E-06 | .6671E-01 | 33 | 37 | .2866E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 210 | -.1953E-05 | 43 | 2 | .9773E-06 | .6673E-01 | 33 | 37 | .2851E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 211 | -.1928E-05 | 43 | 2 | .9713E-06 | .6676E-01 | 33 | 37 | .2837E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 212 | -.1904E-05 | 43 | 2 | .9653E-06 | .6678E-01 | 33 | 37 | .2822E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 213 | -.1881E-05 | 43 | 2 | .9593E-06 | .6681E-01 | 33 | 37 | .2808E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
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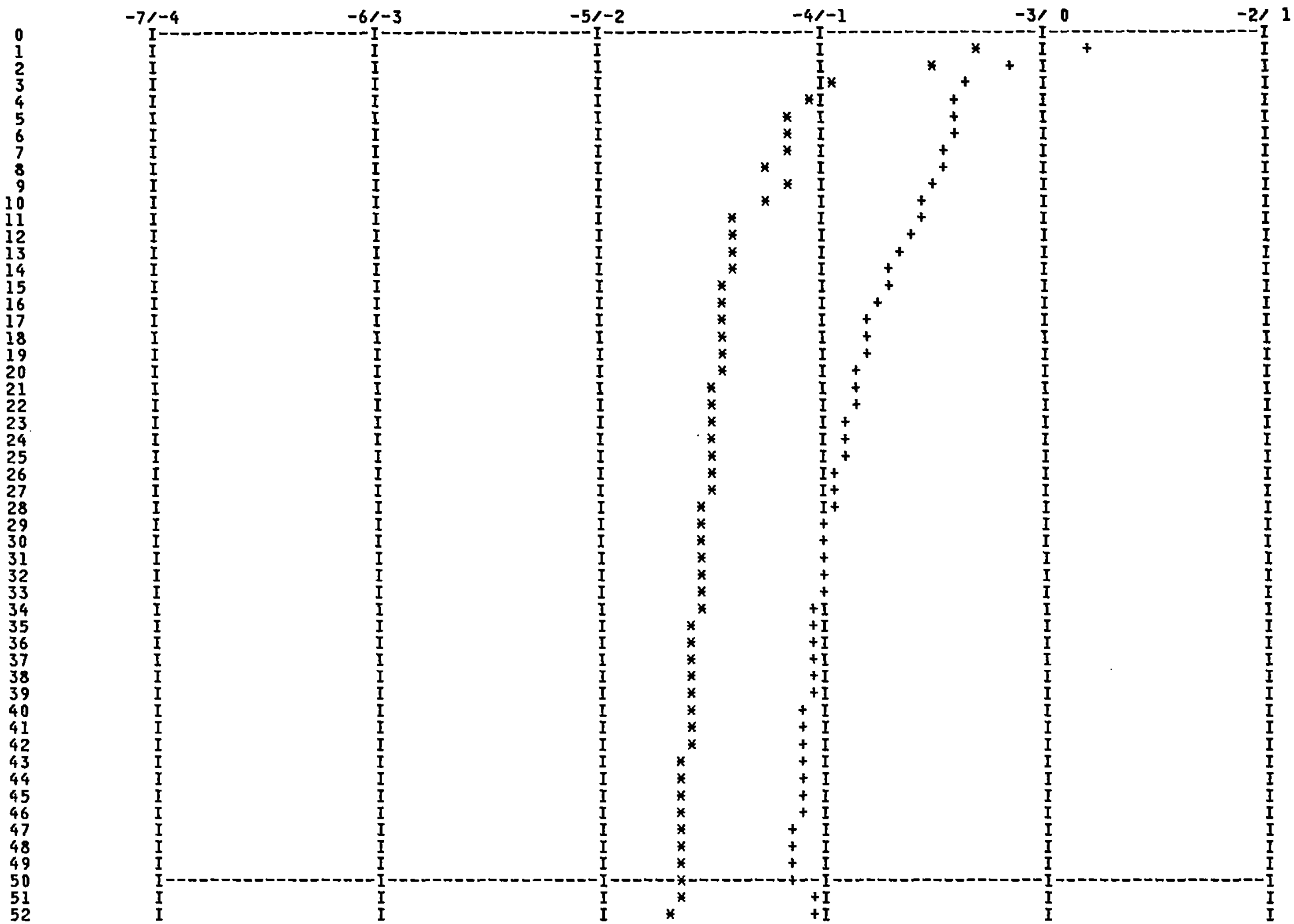
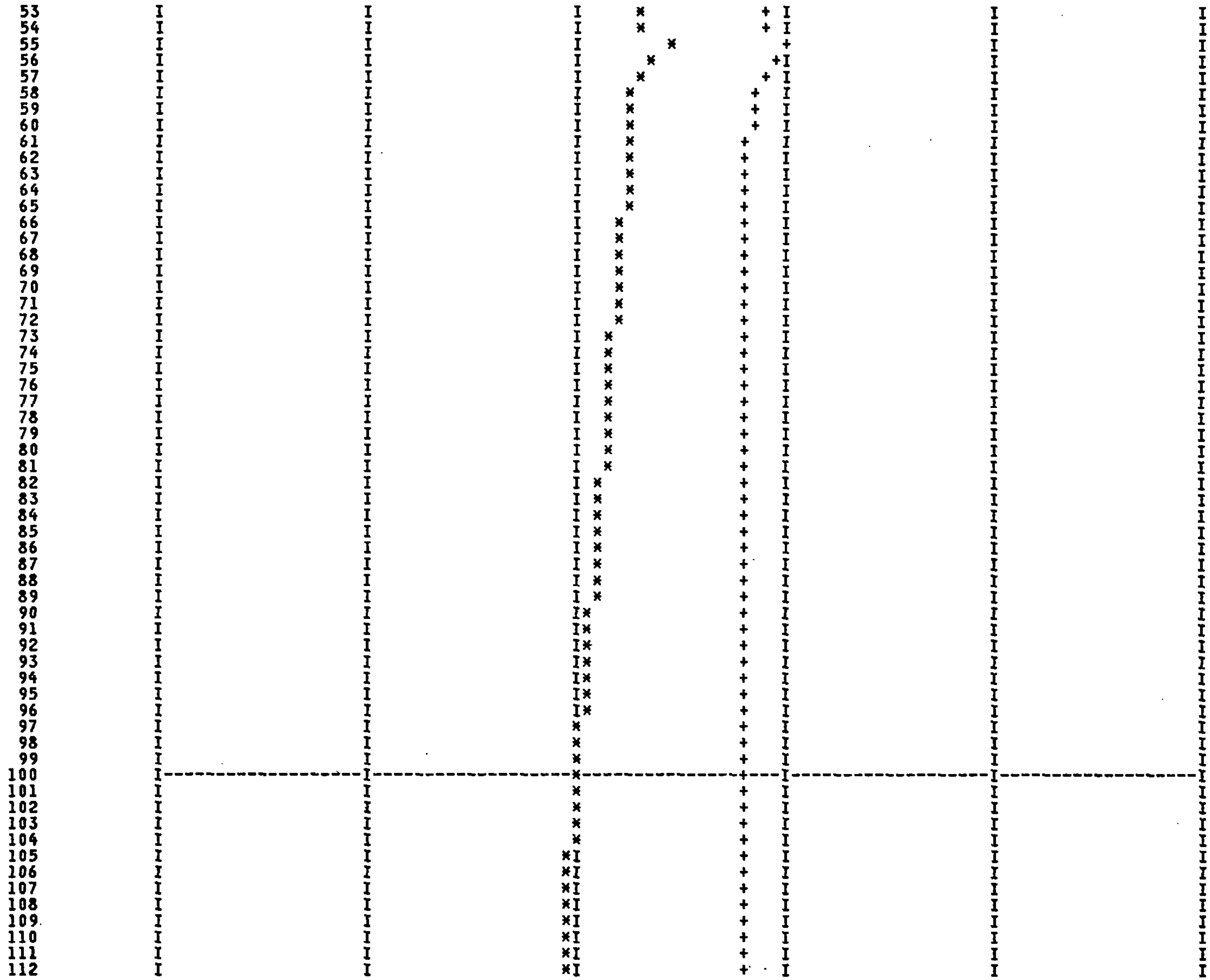
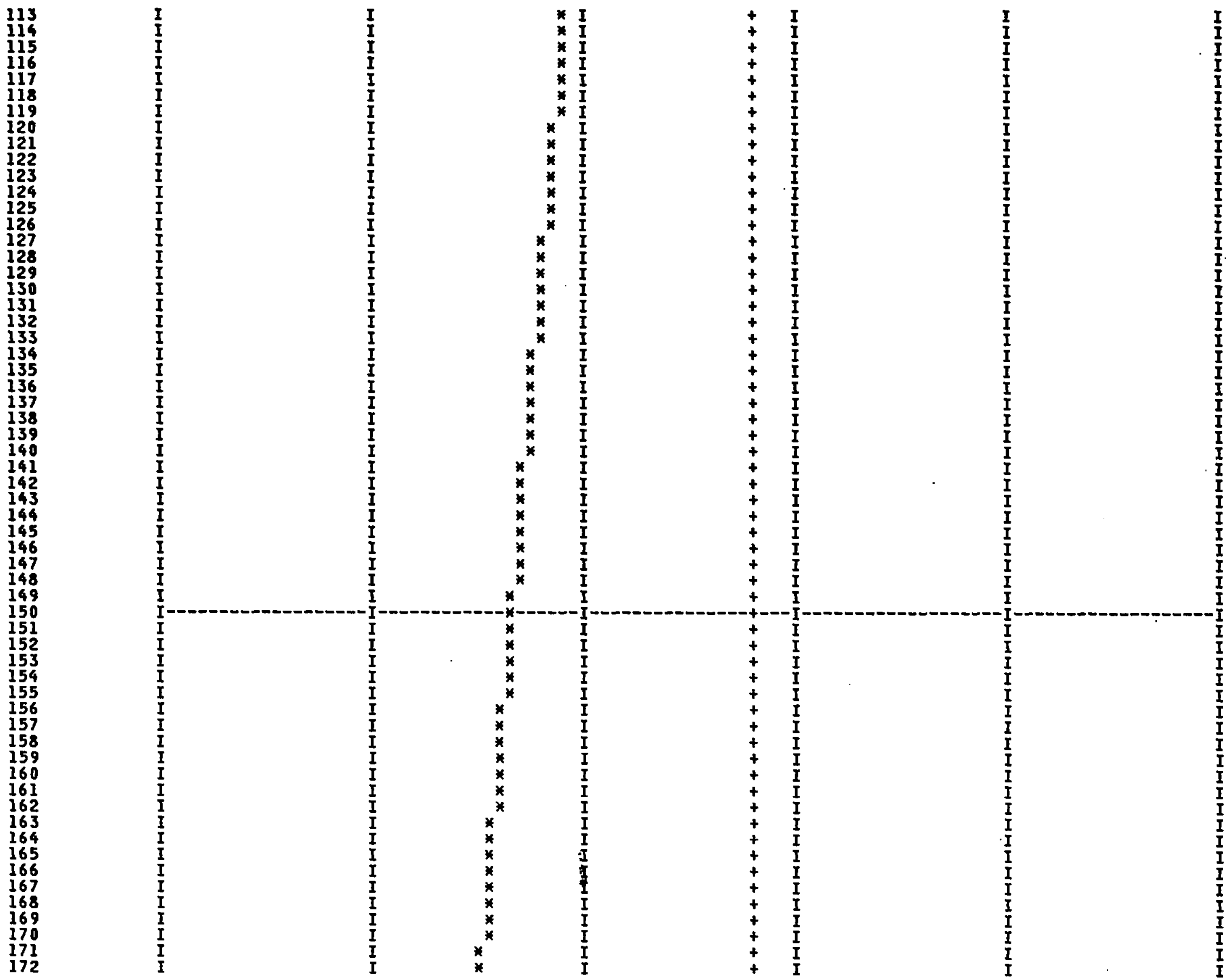
| 215 | -.1835E-05 | 43 | 2 | .9474E-06 | .6686E-01 | 33 | 37 | .2780E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 216 | -.1812E-05 | 43 | 2 | .9415E-06 | .6688E-01 | 33 | 37 | .2766E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 217 | -.1790E-05 | 43 | 2 | .9357E-06 | .6691E-01 | 33 | 37 | .2752E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 218 | -.1768E-05 | 43 | 2 | .9299E-06 | .6693E-01 | 33 | 37 | .2738E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 219 | -.1747E-05 | 43 | 2 | .9241E-06 | .6696E-01 | 33 | 37 | .2724E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 220 | -.1726E-05 | 43 | 2 | .9184E-06 | .6698E-01 | 33 | 37 | .2710E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 221 | -.1705E-05 | 43 | 2 | .9127E-06 | .6700E-01 | 33 | 37 | .2697E-02 | 374 | 0 | 40 | 2 | 38 | 26 |

| ITER | DELMX | I | J | DELAVG | RESMX | I | J | RESAVG | KSUP | NPVD | JSHMAX | ISHMAX | JSHMIN | ISHMIN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 222 | -.1685E-05 | 43 | 2 | .9070E-06 | .6703E-01 | 33 | 37 | .2683E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 223 | -.1665E-05 | 43 | 2 | .9014E-06 | .6705E-01 | 33 | 37 | .2670E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 224 | -.1645E-05 | 43 | 2 | .8958E-06 | .6708E-01 | 33 | 37 | .2656E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 225 | -.1626E-05 | 43 | 2 | .8902E-06 | .6710E-01 | 33 | 37 | .2643E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 226 | -.1607E-05 | 43 | 2 | .8847E-06 | .6713E-01 | 33 | 37 | .2630E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 227 | -.1588E-05 | 43 | 2 | .8792E-06 | .6715E-01 | 33 | 37 | .2617E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 228 | -.1569E-05 | 43 | 2 | .8738E-06 | .6717E-01 | 33 | 37 | .2604E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 229 | -.1551E-05 | 43 | 2 | .8684E-06 | .6720E-01 | 33 | 37 | .2591E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 230 | -.1533E-05 | 43 | 2 | .8630E-06 | .6722E-01 | 33 | 37 | .2578E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 231 | -.1516E-05 | 43 | 2 | .8576E-06 | .6724E-01 | 33 | 37 | .2565E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 232 | -.1498E-05 | 43 | 2 | .8523E-06 | .6727E-01 | 33 | 37 | .2552E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 233 | -.1481E-05 | 43 | 2 | .8471E-06 | .6729E-01 | 33 | 37 | .2540E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 234 | -.1464E-05 | 43 | 2 | .8418E-06 | .6731E-01 | 33 | 37 | .2527E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 235 | -.1448E-05 | 43 | 2 | .8366E-06 | .6734E-01 | 33 | 37 | .2515E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 236 | -.1431E-05 | 43 | 2 | .8315E-06 | .6736E-01 | 33 | 37 | .2502E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 237 | -.1415E-05 | 43 | 2 | .8264E-06 | .6738E-01 | 33 | 37 | .2490E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 238 | -.1399E-05 | 43 | 2 | .8213E-06 | .6740E-01 | 33 | 37 | .2478E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 239 | -.1384E-05 | 43 | 2 | .8162E-06 | .6743E-01 | 33 | 37 | .2465E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 240 | -.1368E-05 | 43 | 2 | .8112E-06 | .6745E-01 | 33 | 37 | .2453E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 241 | -.1353E-05 | 43 | 2 | .8062E-06 | .6747E-01 | 33 | 37 | .2441E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 242 | -.1338E-05 | 43 | 2 | .8012E-06 | .6749E-01 | 33 | 37 | .2429E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 243 | -.1324E-05 | 43 | 2 | .7963E-06 | .6752E-01 | 33 | 37 | .2417E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 244 | -.1310E-05 | 8 | 2 | .7914E-06 | .6754E-01 | 33 | 37 | .2406E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 245 | -.1304E-05 | 8 | 2 | .7866E-06 | .6756E-01 | 33 | 37 | .2394E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 246 | -.1298E-05 | 8 | 2 | .7817E-06 | .6758E-01 | 33 | 37 | .2382E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 247 | -.1292E-05 | 8 | 2 | .7770E-06 | .6760E-01 | 33 | 37 | .2371E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 248 | -.1286E-05 | 8 | 2 | .7722E-06 | .6763E-01 | 33 | 37 | .2359E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 249 | -.1280E-05 | 8 | 2 | .7675E-06 | .6765E-01 | 33 | 37 | .2348E-02 | 374 | 0 | 40 | 2 | 38 | 26 |
| 250 | -.1274E-05 | 8 | 2 | .7628E-06 | .6767E-01 | 33 | 37 | .2336E-02 | 374 | 0 | 40 | 2 | 38 | 26 |

CONVERGENCE HISTORY
INITIAL ERROR(*) IS .5191E-03 INITIAL RESIDUAL(+) IS .1648E+01



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173           I                   I         *         I               +   I                   I                   I
174           I                   I         *         I               +   I                   I                   I
175           I                   I         *         I               +   I                   I                   I
176           I                   I         *         I               +   I                   I                   I
177           I                   I         *         I               +   I                   I                   I
178           I                   I         *         I               +   I                   I                   I
179           I                   I        *          I               +   I                   I                   I
180           I                   I        *          I               +   I                   I                   I
181           I                   I        *          I               +   I                   I                   I
182           I                   I        *          I               +   I                   I                   I
183           I                   I        *          I               +   I                   I                   I
184           I                   I        *          I               +   I                   I                   I
185           I                   I        *          I               +   I                   I                   I
186           I                   I        *          I               +   I                   I                   I
187           I                   I       *           I               +   I                   I                   I
188           I                   I       *           I               +   I                   I                   I
189           I                   I       *           I               +   I                   I                   I
190           I                   I       *           I               +   I                   I                   I
191           I                   I       *           I               +   I                   I                   I
192           I                   I       *           I               +   I                   I                   I
193           I                   I       *           I               +   I                   I                   I
194           I                   I       *           I               +   I                   I                   I
195           I                   I       *           I               +   I                   I                   I
196           I                   I      *            I               +   I                   I                   I
197           I                   I      *            I               +   I                   I                   I
198           I                   I      *            I               +   I                   I                   I
199           I                   I      *            I               +   I                   I                   I
200           I-------------------I------*------------I---------------+---I-------------------I-------------------I
201           I                   I      *            I               +   I                   I                   I
202           I                   I      *            I               +   I                   I                   I
203           I                   I      *            I               +   I                   I                   I
204           I                   I     *             I               +   I                   I                   I
205           I                   I     *             I               +   I                   I                   I
206           I                   I     *             I               +   I                   I                   I
207           I                   I     *             I               +   I                   I                   I
208           I                   I     *             I               +   I                   I                   I
209           I                   I     *             I               +   I                   I                   I
210           I                   I     *             I               +   I                   I                   I
211           I                   I     *             I               +   I                   I                   I
212           I                   I     *             I               +   I                   I                   I
213           I                   I    *              I               +   I                   I                   I
214           I                   I    *              I               +   I                   I                   I
215           I                   I    *              I                +  I                   I                   I
216           I                   I    *              I                +  I                   I                   I
217           I                   I    *              I                +  I                   I                   I
218           I                   I    *              I                +  I                   I                   I
219           I                   I    *              I                +  I                   I                   I
220           I                   I    *              I                +  I                   I                   I
221           I                   I    *              I                +  I                   I                   I
222           I                   I    *              I                +  I                   I                   I
223           I                   I   *               I                +  I                   I                   I
224           I                   I   *               I                +  I                   I                   I
225           I                   I   *               I                +  I                   I                   I
226           I                   I   *               I                +  I                   I                   I
227           I                   I   *               I                +  I                   I                   I
228           I                   I   *               I                +  I                   I                   I
229           I                   I   *               I                +  I                   I                   I
230           I                   I   *               I                +  I                   I                   I
231           I                   I   *               I                +  I                   I                   I
232           I                   I   *               I                +  I                   I                   I
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233           I                   I  *                I                +  I                   I                   I
234           I                   I  *                I                +  I                   I                   I
235           I                   I  *                I                +  I                   I                   I
236           I                   I  *                I                +  I                   I                   I
237           I                   I  *                I                +  I                   I                   I
238           I                   I  *                I                +  I                   I                   I
239           I                   I  *                I                +  I                   I                   I
240           I                   I  *                I                +  I                   I                   I
241           I                   I  *                I                +  I                   I                   I
242           I                   I  *                I                +  I                   I                   I
243           I                   I *                 I                +  I                   I                   I
244           I                   I *                 I                +  I                   I                   I
245           I                   I *                 I                +  I                   I                   I
246           I                   I *                 I                +  I                   I                   I
247           I                   I *                 I                +  I                   I                   I
248           I                   I *                 I                +  I                   I                   I
249           I                   I *                 I                +  I                   I                   I
250           I-------------------I-x-----------------I----------------+--I-------------------I-------------------I
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BASIC RESULTS

| I | J | RHO | THE | F | U | V | MC | M | CP |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 | .33265E+00 | -.15708E+01 | -.83326E-01 | .12312E-14 | -.88818E-14 | .13803E-13 | .13728E+01 | .23372E+00 |
| 3 | 2 | .32955E+00 | -.15147E+01 | -.84226E-01 | -.15316E-01 | .26164E-02 | .23918E-01 | .13726E+01 | .23394E+00 |
| 4 | 2 | .32632E+00 | -.14586E+01 | -.84626E-01 | -.33470E-01 | .60958E-02 | .52362E-01 | .13719E+01 | .23469E+00 |
| 5 | 2 | .32287E+00 | -.14025E+01 | -.84604E-01 | -.51959E-01 | .10012E-01 | .81423E-01 | .13707E+01 | .23599E+00 |
| 6 | 2 | .31934E+00 | -.13464E+01 | -.84104E-01 | -.70185E-01 | .13476E-01 | .10993E+00 | .13690E+01 | .23784E+00 |
| 7 | 2 | .31599E+00 | -.12903E+01 | -.83027E-01 | -.88265E-01 | .15503E-01 | .13779E+00 | .13669E+01 | .24019E+00 |
| 8 | 2 | .31311E+00 | -.12342E+01 | -.81301E-01 | -.10664E+00 | .15357E-01 | .16558E+00 | .13644E+01 | .24287E+00 |
| 9 | 2 | .31093E+00 | -.11781E+01 | -.78920E-01 | -.12595E+00 | .12755E-01 | .19447E+00 | .13620E+01 | .24553E+00 |
| 10 | 2 | .30958E+00 | -.11220E+01 | -.75969E-01 | -.14627E+00 | .85884E-02 | .22498E+00 | .13598E+01 | .24790E+00 |
| 11 | 2 | .30889E+00 | -.10659E+01 | -.72629E-01 | -.16706E+00 | .39272E-02 | .25648E+00 | .13580E+01 | .24996E+00 |
| 12 | 2 | .30876E+00 | -.10098E+01 | -.69033E-01 | -.18780E+00 | -.12965E-02 | .28816E+00 | .13564E+01 | .25175E+00 |
| 13 | 2 | .30913E+00 | -.95370E+00 | -.65287E-01 | -.20838E+00 | -.69176E-02 | .31984E+00 | .13551E+01 | .25314E+00 |
| 14 | 2 | .30992E+00 | -.89760E+00 | -.61496E-01 | -.22870E+00 | -.12438E-01 | .35128E+00 | .13542E+01 | .25410E+00 |
| 15 | 2 | .31102E+00 | -.84150E+00 | -.57751E-01 | -.24848E+00 | -.17384E-01 | .38200E+00 | .13537E+01 | .25465E+00 |
| 16 | 2 | .31236E+00 | -.78540E+00 | -.54124E-01 | -.26709E+00 | -.20853E-01 | .41081E+00 | .13532E+01 | .25522E+00 |
| 17 | 2 | .31376E+00 | -.72930E+00 | -.50663E-01 | -.28334E+00 | -.22340E-01 | .43572E+00 | .13519E+01 | .25667E+00 |
| 18 | 2 | .31513E+00 | -.67320E+00 | -.47368E-01 | -.29612E+00 | -.22359E-01 | .45500E+00 | .13490E+01 | .25986E+00 |
| 19 | 2 | .31643E+00 | -.61710E+00 | -.44221E-01 | -.30493E+00 | -.21634E-01 | .46792E+00 | .13442E+01 | .26527E+00 |
| 20 | 2 | .31765E+00 | -.56100E+00 | -.41203E-01 | -.30966E+00 | -.20938E-01 | .47443E+00 | .13373E+01 | .27297E+00 |
| 21 | 2 | .31884E+00 | -.50490E+00 | -.38304E-01 | -.31026E+00 | -.20796E-01 | .47450E+00 | .13285E+01 | .28303E+00 |
| 22 | 2 | .32005E+00 | -.44880E+00 | -.35523E-01 | -.30715E+00 | -.22836E-01 | .46904E+00 | .13181E+01 | .29490E+00 |
| 23 | 2 | .32151E+00 | -.39270E+00 | -.32872E-01 | -.30277E+00 | -.29510E-01 | .46237E+00 | .13082E+01 | .30626E+00 |
| 24 | 2 | .32357E+00 | -.33660E+00 | -.30420E-01 | -.29893E+00 | -.38866E-01 | .45747E+00 | .13002E+01 | .31558E+00 |
| 25 | 2 | .32623E+00 | -.28050E+00 | -.28260E-01 | -.29373E+00 | -.47416E-01 | .45084E+00 | .12925E+01 | .32471E+00 |
| 26 | 2 | .32948E+00 | -.22440E+00 | -.26434E-01 | -.28124E+00 | -.53512E-01 | .43281E+00 | .12807E+01 | .33861E+00 |
| 27 | 2 | .33327E+00 | -.16830E+00 | -.24951E-01 | -.24830E+00 | -.52778E-01 | .38205E+00 | .12572E+01 | .36703E+00 |
| 28 | 2 | .33743E+00 | -.11220E+00 | -.23796E-01 | -.15148E+00 | -.29818E-01 | .23018E+00 | .12074E+01 | .42908E+00 |
| 29 | 2 | .34073E+00 | -.56100E-01 | -.22981E-01 | .13615E+00 | .22571E-01 | .20554E+00 | .12015E+01 | .43659E+00 |
| 30 | 2 | .34375E+00 | -.71054E-14 | -.22490E-01 | .59397E+00 | .10439E+00 | .97607E+00 | .16156E+01 | .35330E-02 |
| 31 | 2 | .34751E+00 | .56100E-01 | -.21824E-01 | .78460E+00 | .10611E+00 | .13813E+01 | .19602E+01 | -.22031E+00 |
| 32 | 2 | .34902E+00 | .11220E+00 | -.20610E-01 | .87056E+00 | .53309E-01 | .15905E+01 | .21590E+01 | -.30667E+00 |
| 33 | 2 | .34990E+00 | .16830E+00 | -.18863E-01 | .88246E+00 | .36345E-01 | .16253E+01 | .21997E+01 | -.32134E+00 |
| 34 | 2 | .35064E+00 | .22440E+00 | -.16618E-01 | .87762E+00 | .31600E-01 | .16168E+01 | .22015E+01 | -.32198E+00 |
| 35 | 2 | .35132E+00 | .28050E+00 | -.13868E-01 | .87158E+00 | .27986E-01 | .16063E+01 | .22039E+01 | -.32280E+00 |
| 36 | 2 | .35191E+00 | .33660E+00 | -.10572E-01 | .86529E+00 | .22086E-01 | .15962E+01 | .22091E+01 | -.32460E+00 |
| 37 | 2 | .35233E+00 | .39270E+00 | -.67184E-02 | .85253E+00 | .16727E-01 | .15697E+01 | .22013E+01 | -.32190E+00 |
| 38 | 2 | .35268E+00 | .44880E+00 | -.24226E-02 | .83077E+00 | .19954E-01 | .15209E+01 | .21750E+01 | -.31256E+00 |
| 39 | 2 | .35328E+00 | .50490E+00 | .21818E-02 | .80450E+00 | .28822E-01 | .14628E+01 | .21429E+01 | -.30061E+00 |
| 40 | 2 | .35410E+00 | .56100E+00 | .70410E-02 | .77724E+00 | .36065E-01 | .14045E+01 | .21135E+01 | -.28914E+00 |
| 41 | 2 | .35512E+00 | .61710E+00 | .12125E-01 | .74969E+00 | .41084E-01 | .13477E+01 | .20881E+01 | -.27883E+00 |
| 42 | 2 | .35629E+00 | .67320E+00 | .17411E-01 | .72161E+00 | .43656E-01 | .12912E+01 | .20659E+01 | -.26944E+00 |
| 43 | 2 | .35754E+00 | .72930E+00 | .22869E-01 | .68880E+00 | .43467E-01 | .12251E+01 | .20382E+01 | -.25732E+00 |
| 44 | 2 | .35882E+00 | .78540E+00 | .28306E-01 | .62895E+00 | .37839E-01 | .11006E+01 | .19659E+01 | -.22318E+00 |
| 45 | 2 | .35996E+00 | .84150E+00 | .32649E-01 | .58115E+00 | .28924E-01 | .10065E+01 | .19217E+01 | -.20035E+00 |
| 46 | 2 | .36083E+00 | .89760E+00 | .37417E-01 | .55930E+00 | .18416E-01 | .96845E+00 | .19238E+01 | -.20148E+00 |
| 47 | 2 | .36129E+00 | .95370E+00 | .42367E-01 | .52792E+00 | .55389E-02 | .91169E+00 | .19140E+01 | -.19628E+00 |
| 48 | 2 | .36125E+00 | .10098E+01 | .47354E-01 | .49006E+00 | -.82709E-02 | .84349E+00 | .18985E+01 | -.18780E+00 |
| 49 | 2 | .36061E+00 | .10659E+01 | .52272E-01 | .44748E+00 | -.21473E-01 | .76791E+00 | .18805E+01 | -.17776E+00 |
| 50 | 2 | .35931E+00 | .11220E+01 | .57053E-01 | .40052E+00 | -.34070E-01 | .68613E+00 | .18614E+01 | -.16683E+00 |
| 51 | 2 | .35718E+00 | .11781E+01 | .61635E-01 | .34814E+00 | -.44620E-01 | .59643E+00 | .18410E+01 | -.15479E+00 |
| 52 | 2 | .35417E+00 | .12342E+01 | .65890E-01 | .29177E+00 | -.49003E-01 | .50057E+00 | .18211E+01 | -.14270E+00 |
| 53 | 2 | .35051E+00 | .12903E+01 | .69684E-01 | .23530E+00 | -.46058E-01 | .40422E+00 | .18047E+01 | -.13252E+00 |
| 54 | 2 | .34648E+00 | .13464E+01 | .72940E-01 | .18155E+00 | -.37870E-01 | .31188E+00 | .17932E+01 | -.12522E+00 |
| 55 | 2 | .34240E+00 | .14025E+01 | .75630E-01 | .13156E+00 | -.27211E-01 | .22557E+00 | .17862E+01 | -.12069E+00 |
| 56 | 2 | .33853E+00 | .14586E+01 | .77767E-01 | .85121E-01 | -.16596E-01 | .14549E+00 | .17824E+01 | -.11825E+00 |
| 57 | 2 | .33500E+00 | .15147E+01 | .79406E-01 | .41361E-01 | -.76065E-02 | .70529E-01 | .17808E+01 | -.11716E+00 |
| 58 | 2 | .33162E+00 | .15708E+01 | .80668E-01 | .11382E-13 | .26645E-14 | .19603E-13 | .17803E+01 | -.11687E+00 |

SURFACE RESULTS

| I | X/XMAX | Y/XMAX | PSI | OMEG | CP | MC | U | V | W | BETA | VS | WS | UC | VC | WC | DELT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | -.0000 | -.0218 | .81 | -90.00 | .2337 | .0000 | .8918 | -.0000 | .0000 | .00 | ******** | 159.30 | .0000 | -.0126 | .8917 | 0.0 |
| 3 | .0523 | -.0131 | 2.01 | -14.06 | .2339 | .0239 | .8916 | -.0000 | -.0155 | -1.00 | -66.36 | .01 | .0150 | -.0102 | .8915 | -66.3 |
| 4 | .1046 | -.0041 | 3.89 | -2.27 | .2347 | .0524 | .8907 | -.0000 | -.0340 | -2.19 | -77.72 | .04 | .0269 | -.0083 | .8909 | -77.6 |
| 5 | .1568 | .0053 | 5.82 | 1.95 | .2360 | .0814 | .8892 | -.0000 | -.0529 | -3.41 | -81.61 | .05 | .0383 | -.0065 | .8900 | -81.5 |
| 6 | .2088 | .0149 | 7.74 | 4.07 | .2378 | .1099 | .8871 | -.0000 | -.0715 | -4.61 | -84.12 | .08 | .0494 | -.0039 | .8886 | -84.0 |
| 7 | .2605 | .0236 | 9.64 | 5.17 | .2402 | .1378 | .8844 | -.0000 | -.0896 | -5.79 | -86.57 | .12 | .0602 | -.0001 | .8869 | -86.4 |
| 8 | .3118 | .0306 | 11.50 | 5.60 | .2429 | .1656 | .8813 | -.0000 | -.1077 | -6.97 | -89.27 | .18 | .0699 | .0051 | .8850 | -89.0 |
| 9 | .3625 | .0352 | 13.31 | 5.54 | .2455 | .1945 | .8776 | -.0000 | -.1266 | -8.21 | -92.20 | .29 | .0781 | .0118 | .8831 | -91.9 |
| 10 | .4126 | .0371 | 15.06 | 5.13 | .2479 | .2250 | .8734 | -.0000 | -.1465 | -9.52 | -94.23 | -.15 | .0845 | .0185 | .8814 | -94.3 |
| 11 | .4617 | .0368 | 16.74 | 4.55 | .2500 | .2565 | .8688 | -.0000 | -.1671 | -10.89 | -95.59 | -.63 | .0894 | .0253 | .8799 | -96.2 |
| 12 | .5097 | .0347 | 18.35 | 3.90 | .2517 | .2882 | .8638 | -.0000 | -.1878 | -12.27 | -97.15 | -.54 | .0934 | .0315 | .8785 | -97.6 |
| 13 | .5565 | .0312 | 19.90 | 3.21 | .2531 | .3198 | .8584 | -.0000 | -.2085 | -13.65 | -98.23 | -.59 | .0965 | .0374 | .8773 | -98.8 |
| 14 | .6019 | .0265 | 21.37 | 2.52 | .2541 | .3513 | .8527 | -.0000 | -.2290 | -15.03 | -98.92 | -.69 | .0986 | .0426 | .8764 | -99.6 |
| 15 | .6458 | .0212 | 22.76 | 1.88 | .2547 | .3820 | .8469 | -.0000 | -.2491 | -16.39 | -99.26 | -.79 | .1000 | .0467 | .8758 | -100.0 |
| 16 | .6879 | .0154 | 24.07 | 1.28 | .2552 | .4108 | .8408 | -.0000 | -.2679 | -17.67 | -99.17 | -.86 | .1011 | .0490 | .8753 | -100.0 |
| 17 | .7281 | .0098 | 25.31 | .77 | .2567 | .4357 | .8348 | -.0000 | -.2842 | -18.80 | -98.72 | -.91 | .1029 | .0490 | .8745 | -99.6 |
| 18 | .7662 | .0045 | 26.45 | .33 | .2599 | .4550 | .8289 | -.0000 | -.2970 | -19.71 | -98.11 | -.94 | .1064 | .0473 | .8727 | -99.0 |
| 19 | .8021 | -.0004 | 27.51 | -.03 | .2653 | .4679 | .8232 | -.0000 | -.3057 | -20.37 | -97.49 | -.95 | .1122 | .0448 | .8698 | -98.4 |
| 20 | .8356 | -.0047 | 28.49 | -.32 | .2730 | .4744 | .8180 | -.0000 | -.3104 | -20.78 | -96.98 | -.96 | .1202 | .0422 | .8655 | -97.9 |
| 21 | .8664 | -.0086 | 29.36 | -.57 | .2830 | .4745 | .8132 | -.0000 | -.3110 | -20.93 | -96.63 | -.98 | .1305 | .0399 | .8598 | -97.6 |
| 22 | .8944 | -.0121 | 30.15 | -.78 | .2949 | .4690 | .8089 | -.0000 | -.3080 | -20.85 | -96.63 | -1.06 | .1429 | .0392 | .8528 | -97.6 |
| 23 | .9193 | -.0155 | 30.84 | -.96 | .3063 | .4624 | .8052 | -.0000 | -.3042 | -20.70 | -97.22 | -1.26 | .1552 | .0422 | .8456 | -98.4 |
| 24 | .9410 | -.0188 | 31.43 | -1.14 | .3156 | .4575 | .8020 | -.0000 | -.3014 | -20.60 | -97.84 | -1.46 | .1654 | .0454 | .8395 | -99.3 |
| 25 | .9594 | -.0218 | 31.93 | -1.30 | .3247 | .4508 | .7994 | -.0000 | -.2975 | -20.42 | -97.62 | -1.61 | .1746 | .0438 | .8337 | -99.2 |
| 26 | .9745 | -.0241 | 32.33 | -1.42 | .3386 | .4328 | .7973 | -.0000 | -.2863 | -19.75 | -95.78 | -1.79 | .1875 | .0331 | .8255 | -97.5 |
| 27 | .9861 | -.0254 | 32.64 | -1.47 | .3670 | .3820 | .7958 | -.0000 | -.2539 | -17.69 | -90.83 | -1.74 | .2159 | .0058 | .8069 | -92.5 |
| 28 | .9944 | -.0253 | 32.86 | -1.46 | .4291 | .2302 | .7950 | -.0000 | -.1544 | -10.99 | -80.53 | 2.36 | .3035 | -.0394 | .7498 | -78.1 |
| 29 | .9990 | -.0236 | 32.98 | -1.35 | .4366 | .2055 | .7949 | .0000 | .1380 | 9.85 | -37.18 | -6.50 | .5149 | .0877 | .6149 | -43.6 |
| 30 | 1.0000 | -.0206 | 33.00 | -1.18 | .0035 | .9761 | .7955 | .0000 | .6031 | 37.17 | 1.29 | 9.78 | .3483 | .5848 | .7302 | 11.0 |
| 31 | .9976 | -.0164 | 32.94 | -.94 | -.2203 | 1.3813 | .7972 | -.0000 | .7917 | 44.80 | 40.20 | -.22 | .0166 | .6065 | .9457 | 39.9 |
| 32 | .9910 | -.0117 | 32.76 | -.68 | -.3067 | 1.5905 | .8006 | -.0000 | .8722 | 47.45 | 59.71 | -3.27 | -.1722 | .4842 | 1.0666 | 56.4 |
| 33 | .9806 | -.0068 | 32.49 | -.40 | -.3213 | 1.6253 | .8054 | -.0000 | .8832 | 47.64 | 67.35 | -3.15 | -.2354 | .3860 | 1.1065 | 64.2 |
| 34 | .9666 | -.0016 | 32.12 | -.10 | -.3220 | 1.6168 | .8116 | -.0000 | .8782 | 47.26 | 71.25 | -2.83 | -.2596 | .3233 | 1.1216 | 68.4 |
| 35 | .9493 | .0038 | 31.65 | .23 | -.3228 | 1.6063 | .8192 | -.0000 | .8720 | 46.79 | 73.71 | -2.52 | -.2739 | .2801 | 1.1305 | 71.1 |
| 36 | .9286 | .0092 | 31.09 | .57 | -.3246 | 1.5962 | .8281 | -.0000 | .8656 | 46.27 | 75.55 | -2.22 | -.2849 | .2455 | 1.1374 | 73.3 |
| 37 | .9048 | .0147 | 30.44 | .93 | -.3219 | 1.5697 | .8383 | -.0000 | .8527 | 45.49 | 76.93 | -1.95 | -.2889 | .2163 | 1.1400 | 74.9 |
| 38 | .8780 | .0201 | 29.70 | 1.31 | -.3126 | 1.5209 | .8496 | -.0000 | .8310 | 44.37 | 77.46 | -1.77 | -.2832 | .1989 | 1.1369 | 75.7 |
| 39 | .8486 | .0258 | 28.87 | 1.74 | -.3006 | 1.4628 | .8618 | -.0000 | .8050 | 43.05 | 77.33 | -1.69 | -.2728 | .1915 | 1.1312 | 75.6 |
| 40 | .8166 | .0319 | 27.95 | 2.24 | -.2891 | 1.4045 | .8749 | -.0000 | .7781 | 41.65 | 77.00 | -1.62 | -.2624 | .1863 | 1.1257 | 75.3 |
| 41 | .7823 | .0384 | 26.96 | 2.81 | -.2788 | 1.3477 | .8886 | -.0000 | .7508 | 40.20 | 76.59 | -1.55 | -.2529 | .1817 | 1.1209 | 75.0 |
| 42 | .7460 | .0451 | 25.89 | 3.46 | -.2694 | 1.2912 | .9029 | -.0000 | .7229 | 38.68 | 76.14 | -1.47 | -.2442 | .1766 | 1.1167 | 74.6 |
| 43 | .7076 | .0521 | 24.74 | 4.21 | -.2573 | 1.2251 | .9176 | -.0000 | .6902 | 36.95 | 75.71 | -1.37 | -.2326 | .1697 | 1.1115 | 74.3 |
| 44 | .6675 | .0591 | 23.52 | 5.06 | -.2232 | 1.1006 | .9325 | -.0000 | .6301 | 34.05 | 75.45 | -1.26 | -.1982 | .1548 | 1.0970 | 74.1 |
| 45 | .6257 | .0658 | 22.22 | 6.00 | -.2004 | 1.0065 | .9464 | -.0000 | .5819 | 31.59 | 75.51 | -1.13 | -.1763 | .1390 | 1.0880 | 74.3 |
| 46 | .5825 | .0718 | 20.86 | 7.03 | -.2015 | .9684 | .9605 | -.0000 | .5596 | 30.23 | 75.86 | -1.00 | -.1794 | .1251 | 1.0899 | 74.8 |
| 47 | .5378 | .0768 | 19.43 | 8.13 | -.1963 | .9117 | .9746 | -.0000 | .5279 | 28.45 | 76.50 | -.88 | -.1750 | .1074 | 1.0892 | 75.6 |
| 48 | .4919 | .0804 | 17.94 | 9.28 | -.1878 | .8435 | .9883 | -.0000 | .4901 | 26.38 | 77.45 | -.82 | -.1656 | .0878 | 1.0871 | 76.6 |
| 49 | .4450 | .0824 | 16.38 | 10.49 | -.1778 | .7679 | 1.0014 | -.0000 | .4480 | 24.10 | 78.78 | -.95 | -.1527 | .0678 | 1.0842 | 77.8 |
| 50 | .3972 | .0824 | 14.76 | 11.72 | -.1668 | .6861 | 1.0137 | -.0000 | .4020 | 21.63 | 79.68 | -.34 | -.1363 | .0477 | 1.0809 | 79.3 |
| 51 | .3486 | .0800 | 13.07 | 12.92 | -.1548 | .5964 | 1.0249 | -.0000 | .3510 | 18.90 | 81.15 | .07 | -.1153 | .0285 | 1.0768 | 81.2 |
| 52 | .2994 | .0749 | 11.33 | 14.04 | -.1427 | .5006 | 1.0349 | -.0000 | .2959 | 15.95 | 82.96 | -.01 | -.0908 | .0147 | 1.0724 | 82.9 |
| 53 | .2498 | .0676 | 9.54 | 15.13 | -.1325 | .4042 | 1.0433 | -.0000 | .2398 | 12.94 | 84.03 | -.03 | -.0666 | .0079 | 1.0684 | 84.0 |
| 54 | .2000 | .0587 | 7.71 | 16.37 | -.1252 | .3119 | 1.0501 | -.0000 | .1855 | 10.02 | 84.04 | -.03 | -.0457 | .0068 | 1.0654 | 84.0 |
| 55 | .1501 | .0492 | 5.86 | 18.16 | -.1207 | .2256 | 1.0553 | -.0000 | .1343 | 7.26 | 82.60 | -.02 | -.0290 | .0087 | 1.0634 | 82.5 |
| 56 | .1000 | .0397 | 4.00 | 21.67 | -.1182 | .1455 | 1.0589 | -.0000 | .0867 | 4.68 | 78.81 | -.00 | -.0165 | .0116 | 1.0622 | 78.8 |
| 57 | .0500 | .0307 | 2.18 | 31.56 | -.1172 | .0705 | 1.0610 | -.0000 | .0421 | 2.27 | 68.61 | .00 | -.0069 | .0137 | 1.0617 | 68.6 |
| 58 | .0000 | .0218 | .81 | 90.00 | -.1169 | .0000 | 1.0617 | .0000 | .0000 | .00 | 3930.91 | .18 | .0000 | .0150 | 1.0616 | 0.0 |
| I | X/XMAX | Y/XMAX | PSI | OMEG | CP | MC | U | V | W | BETA | VS | WS | UC | VC | WC | DELT |

IMCMIN= 6 MCMIN= .10993

CROSSFLOW SONIC LINE

NUMBER OF POINTS 30

| J | XXI | YYI |
|---|---|---|
| 1 | .64935 | -.01326 |
| 2 | .65019 | -.01048 |
| 3 | .65110 | -.00685 |
| 4 | .65196 | -.00229 |
| 5 | .65264 | .00352 |
| 6 | .65324 | .01039 |
| 7 | .65350 | .01877 |
| 8 | .65375 | .02825 |
| 9 | .65331 | .03982 |
| 10 | .65255 | .05297 |
| 11 | .65113 | .06821 |
| 12 | .64824 | .08659 |
| 13 | .64345 | .10865 |
| 14 | .63496 | .13674 |
| 15 | .61702 | .17751 |
| 16 | .53378 | .26092 |
| 17 | .49899 | .26641 |
| 18 | .47940 | .25800 |
| 19 | .46802 | .24325 |
| 20 | .45952 | .22662 |
| 21 | .45338 | .20869 |
| 22 | .44902 | .18998 |
| 23 | .44473 | .17145 |
| 24 | .44062 | .15302 |
| 25 | .43652 | .13470 |
| 26 | .43214 | .11653 |
| 27 | .42707 | .09847 |
| 28 | .42094 | .08040 |
| 29 | .41347 | .06204 |
| 30 | .40161 | .04338 |

CONICAL FORCE DISTRIBUTIONS, BODY AND SHOCK LOCATIONS

| I | X(I) | CL | CD | OMEG | XXB | YYB | RB | XXS | YYS | RS | RS/RB |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | -1.5708 | .1063 | .0242 | -90.0000 | -.0000 | -.0142 | .0142 | -.0000 | -.6050 | .6050 | 42.7366 |
| 3 | -1.5147 | .1065 | .0242 | -86.7857 | .0340 | -.0085 | .0350 | .0494 | -.6035 | .6056 | 17.2860 |
| 4 | -1.4586 | .1068 | .0243 | -83.5714 | .0679 | -.0027 | .0680 | .0986 | -.5997 | .6077 | 8.9389 |
| 5 | -1.4025 | .1073 | .0244 | -80.3571 | .1018 | .0035 | .1019 | .1474 | -.5934 | .6115 | 6.0027 |
| 6 | -1.3464 | .1078 | .0244 | -77.1429 | .1356 | .0096 | .1359 | .1956 | -.5850 | .6169 | 4.5388 |
| 7 | -1.2903 | .1083 | .0241 | -73.9286 | .1691 | .0153 | .1698 | .2431 | -.5745 | .6238 | 3.6731 |
| 8 | -1.2342 | .1087 | .0233 | -70.7143 | .2025 | .0198 | .2034 | .2898 | -.5620 | .6323 | 3.1079 |
| 9 | -1.1781 | .1086 | .0221 | -67.5000 | .2354 | .0228 | .2365 | .3354 | -.5475 | .6421 | 2.7144 |
| 10 | -1.1220 | .1080 | .0207 | -64.2857 | .2679 | .0241 | .2690 | .3799 | -.5311 | .6530 | 2.4274 |
| 11 | -1.0659 | .1068 | .0192 | -61.0714 | .2998 | .0239 | .3008 | .4229 | -.5128 | .6647 | 2.2101 |
| 12 | -1.0098 | .1050 | .0177 | -57.8571 | .3310 | .0225 | .3318 | .4643 | -.4926 | .6770 | 2.0405 |
| 13 | -.9537 | .1027 | .0163 | -54.6429 | .3614 | .0202 | .3620 | .5038 | -.4705 | .6893 | 1.9044 |
| 14 | -.8976 | .0998 | .0150 | -51.4286 | .3909 | .0172 | .3913 | .5411 | -.4464 | .7015 | 1.7929 |
| 15 | -.8415 | .0963 | .0138 | -48.2143 | .4193 | .0137 | .4196 | .5764 | -.4210 | .7138 | 1.7012 |
| 16 | -.7854 | .0924 | .0129 | -45.0000 | .4467 | .0100 | .4468 | .6100 | -.3955 | .7270 | 1.6272 |
| 17 | -.7293 | .0885 | .0123 | -41.7857 | .4728 | .0063 | .4728 | .6422 | -.3699 | .7411 | 1.5673 |
| 18 | -.6732 | .0846 | .0119 | -38.5714 | .4976 | .0029 | .4976 | .6724 | -.3438 | .7552 | 1.5177 |
| 19 | -.6171 | .0809 | .0116 | -35.3571 | .5209 | -.0002 | .5209 | .7006 | -.3172 | .7690 | 1.4764 |
| 20 | -.5610 | .0771 | .0112 | -32.1429 | .5426 | -.0031 | .5426 | .7267 | -.2903 | .7825 | 1.4420 |
| 21 | -.5049 | .0731 | .0107 | -28.9286 | .5626 | -.0056 | .5627 | .7507 | -.2631 | .7955 | 1.4138 |
| 22 | -.4488 | .0685 | .0098 | -25.7143 | .5808 | -.0079 | .5809 | .7727 | -.2358 | .8079 | 1.3908 |
| 23 | -.3927 | .0627 | .0085 | -22.5000 | .5970 | -.0100 | .5971 | .7926 | -.2083 | .8195 | 1.3726 |
| 24 | -.3366 | .0554 | .0070 | -19.2857 | .6111 | -.0122 | .6112 | .8104 | -.1807 | .8303 | 1.3584 |
| 25 | -.2805 | .0474 | .0060 | -16.0714 | .6230 | -.0141 | .6232 | .8257 | -.1527 | .8397 | 1.3473 |
| 26 | -.2244 | .0392 | .0056 | -12.8571 | .6328 | -.0156 | .6330 | .8392 | -.1247 | .8484 | 1.3403 |
| 27 | -.1683 | .0313 | .0060 | -9.6429 | .6404 | -.0165 | .6406 | .8523 | -.0968 | .8578 | 1.3391 |
| 28 | -.1122 | .0231 | .0079 | -6.4286 | .6457 | -.0164 | .6460 | .8646 | -.0684 | .8673 | 1.3427 |
| 29 | -.0561 | .0093 | .0083 | -3.2143 | .6487 | -.0153 | .6489 | .8757 | -.0392 | .8766 | 1.3509 |
| 30 | -.0000 | -.0000 | .0001 | -.0000 | .6494 | -.0134 | .6495 | .8857 | -.0088 | .8857 | 1.3637 |
| 31 | .0561 | .0097 | -.0039 | 3.2143 | .6478 | -.0106 | .6479 | .8945 | .0231 | .8947 | 1.3810 |
| 32 | .1122 | .0243 | -.0034 | 6.4286 | .6435 | -.0076 | .6436 | .9018 | .0568 | .9036 | 1.4040 |
| 33 | .1683 | .0358 | -.0016 | 9.6429 | .6368 | -.0044 | .6368 | .9090 | .0928 | .9137 | 1.4349 |
| 34 | .2244 | .0458 | .0001 | 12.8571 | .6277 | -.0010 | .6277 | .9155 | .1314 | .9249 | 1.4734 |
| 35 | .2805 | .0554 | .0018 | 16.0714 | .6164 | .0024 | .6165 | .9192 | .1723 | .9353 | 1.5172 |
| 36 | .3366 | .0649 | .0037 | 19.2857 | .6030 | .0060 | .6031 | .9204 | .2156 | .9453 | 1.5676 |
| 37 | .3927 | .0730 | .0055 | 22.5000 | .5876 | .0095 | .5876 | .9189 | .2611 | .9552 | 1.6256 |
| 38 | .4488 | .0786 | .0067 | 25.7143 | .5702 | .0130 | .5703 | .9145 | .3089 | .9652 | 1.6925 |
| 39 | .5049 | .0824 | .0072 | 28.9286 | .5510 | .0168 | .5513 | .9071 | .3588 | .9755 | 1.7695 |
| 40 | .5610 | .0853 | .0076 | 32.1429 | .5303 | .0207 | .5307 | .8966 | .4108 | .9862 | 1.8583 |
| 41 | .6171 | .0877 | .0080 | 35.3571 | .5080 | .0249 | .5087 | .8826 | .4645 | .9974 | 1.9608 |
| 42 | .6732 | .0895 | .0083 | 38.5714 | .4844 | .0293 | .4853 | .8650 | .5197 | 1.0091 | 2.0793 |
| 43 | .7293 | .0897 | .0086 | 41.7857 | .4595 | .0338 | .4608 | .8434 | .5761 | 1.0213 | 2.2166 |
| 44 | .7854 | .0812 | .0081 | 45.0000 | .4335 | .0384 | .4352 | .8176 | .6332 | 1.0341 | 2.3763 |
| 45 | .8415 | .0757 | .0081 | 48.2143 | .4063 | .0427 | .4086 | .7874 | .6906 | 1.0473 | 2.5634 |
| 46 | .8976 | .0786 | .0092 | 51.4286 | .3782 | .0466 | .3811 | .7527 | .7479 | 1.0611 | 2.7843 |
| 47 | .9537 | .0788 | .0100 | 54.6429 | .3492 | .0499 | .3528 | .7133 | .8046 | 1.0753 | 3.0480 |
| 48 | 1.0098 | .0773 | .0107 | 57.8571 | .3195 | .0522 | .3237 | .6693 | .8602 | 1.0899 | 3.3670 |
| 49 | 1.0659 | .0746 | .0112 | 61.0714 | .2890 | .0535 | .2939 | .6205 | .9141 | 1.1048 | 3.7592 |
| 50 | 1.1220 | .0712 | .0116 | 64.2857 | .2579 | .0535 | .2634 | .5671 | .9656 | 1.1198 | 4.2511 |
| 51 | 1.1781 | .0669 | .0117 | 67.5000 | .2264 | .0519 | .2322 | .5090 | 1.0140 | 1.1345 | 4.8851 |
| 52 | 1.2342 | .0622 | .0116 | 70.7143 | .1944 | .0486 | .2004 | .4463 | 1.0584 | 1.1487 | 5.7316 |
| 53 | 1.2903 | .0580 | .0112 | 73.9286 | .1622 | .0439 | .1681 | .3793 | 1.0976 | 1.1613 | 6.9098 |
| 54 | 1.3464 | .0549 | .0108 | 77.1429 | .1299 | .0381 | .1354 | .3084 | 1.1306 | 1.1719 | 8.6572 |
| 55 | 1.4025 | .0530 | .0105 | 80.3571 | .0974 | .0320 | .1026 | .2343 | 1.1571 | 1.1805 | 11.5116 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 1.4586 | .0519 | .0103 | 83.5714 | .0650 | .0258 | .0699 | .1577 | 1.1763 | 1.1868 | 16.9786 |
| 57 | 1.5147 | .0513 | .0101 | 86.7857 | .0325 | .0199 | .0381 | .0793 | 1.1880 | 1.1907 | 31.2413 |
| 58 | 1.5708 | .0511 | .0101 | 90.0000 | .0000 | .0142 | .0142 | .0000 | 1.1919 | 1.1919 | 84.1924 |

CL = .4535 CD = .0684

CLU= .2001 CLL= .2535

CDU= .0223 CDL= .0461

L/D= 6.629 L/D UPPER = 8.972 L/D LOWER = 5.4964

INITL= 18 IFINL= 42

ETADR= .750 CL(ETADR)= .1495 CD(ETADR)= .0156

DELTA CP , FLAT PLATE LINEAR DCP , AND SPANLOAD DISTRIBUTION

| I | ETASPN | CPU | CPL | DELTACP | DCPLIN | CCL/CA |
|---|---|---|---|---|---|---|
| 1 | .0000 | -.1169 | .2337 | .3506 | .2887 | .7012 |
| 2 | .0500 | -.1172 | .2339 | .3511 | .2891 | .6975 |
| 3 | .1000 | -.1182 | .2346 | .3529 | .2902 | .6926 |
| 4 | .1501 | -.1207 | .2358 | .3565 | .2920 | .6856 |
| 5 | .2000 | -.1252 | .2375 | .3628 | .2947 | .6757 |
| 6 | .2498 | -.1325 | .2397 | .3722 | .2982 | .6570 |
| 7 | .2994 | -.1427 | .2422 | .3849 | .3026 | .6351 |
| 8 | .3486 | -.1548 | .2448 | .3996 | .3080 | .6094 |
| 9 | .3972 | -.1668 | .2472 | .4140 | .3146 | .5802 |
| 10 | .4450 | -.1778 | .2493 | .4270 | .3224 | .5484 |
| 11 | .4919 | -.1878 | .2511 | .4389 | .3316 | .5145 |
| 12 | .5378 | -.1963 | .2526 | .4489 | .3425 | .4795 |
| 13 | .5825 | -.2015 | .2537 | .4552 | .3552 | .4440 |
| 14 | .6257 | -.2004 | .2544 | .4548 | .3701 | .4092 |
| 15 | .6675 | -.2232 | .2549 | .4781 | .3878 | .3743 |
| 16 | .7076 | -.2573 | .2559 | .5133 | .4086 | .3372 |
| 17 | .7460 | -.2694 | .2582 | .5276 | .4335 | .2990 |
| 18 | .7823 | -.2788 | .2623 | .5411 | .4636 | .2615 |
| 19 | .8166 | -.2891 | .2686 | .5577 | .5002 | .2248 |
| 20 | .8486 | -.3006 | .2772 | .5778 | .5457 | .1891 |
| 21 | .8780 | -.3126 | .2880 | .6005 | .6032 | .1548 |
| 22 | .9048 | -.3219 | .2996 | .6216 | .6780 | .1223 |
| 23 | .9286 | -.3246 | .3103 | .6349 | .7782 | .0924 |
| 24 | .9493 | -.3228 | .3197 | .6425 | .9183 | .0660 |
| 25 | .9666 | -.3220 | .3314 | .6534 | 1.1274 | .0435 |
| 26 | .9806 | -.3213 | .3535 | .6748 | 1.4725 | .0250 |
| 27 | .9910 | -.3067 | .4033 | .7099 | 2.1521 | .0106 |
| 28 | .9976 | -.2203 | .4342 | .6545 | 4.1294 | .0016 |
| 29 | 1.0000 | .0035 | .0035 | 0.0000 | 0.0000 | 0.0000 |
| I | ETASPN | CPU | CPL | DELTACP | DCPLIN | CCL/CA |

MODIFICATION OF PRESSURES TO ACCOUNT FOR NON-CONICAL GEOMETRY

| I | MCON | NUCON | YIN | DNY | DNZ | DNX | CPP | CPNC | DELMCH | DELNUD |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.37281 | .14325 | -.00000 | -.16186 | .98572 | -.04639 | .23372 | .11099 | .12074 | 3.50765 |
| 2 | 1.37261 | .14315 | .54348 | -.16549 | .98518 | -.04519 | .23394 | .11326 | .11854 | 3.44287 |
| 3 | 1.37192 | .14281 | 1.08644 | -.17451 | .98370 | -.04324 | .23469 | .11649 | .11585 | 3.36312 |
| 4 | 1.37073 | .14221 | 1.62821 | -.18108 | .98260 | -.04121 | .23599 | .12032 | .11303 | 3.27910 |
| 5 | 1.36903 | .14137 | 2.16809 | -.17544 | .98365 | -.04054 | .23784 | .12468 | .11020 | 3.19441 |
| 6 | 1.36687 | .14030 | 2.70514 | -.15299 | .98731 | -.04231 | .24019 | .13043 | .10641 | 3.08112 |
| 7 | 1.36443 | .13909 | 3.23809 | -.11481 | .99220 | -.04791 | .24287 | .13636 | .10276 | 2.97195 |
| 8 | 1.36200 | .13789 | 3.76527 | -.06531 | .99618 | -.05732 | .24553 | .14199 | .09945 | 2.87275 |
| 9 | 1.35984 | .13682 | 4.28474 | -.01459 | .99757 | -.06791 | .24790 | .14833 | .09519 | 2.74601 |
| 10 | 1.35797 | .13589 | 4.79480 | .02542 | .99668 | -.07731 | .24996 | .15382 | .09154 | 2.63771 |
| 11 | 1.35636 | .13509 | 5.29376 | .05990 | .99449 | -.08579 | .25175 | .15982 | .08716 | 2.50864 |
| 12 | 1.35509 | .13447 | 5.77985 | .08935 | .99164 | -.09293 | .25314 | .16677 | .08153 | 2.34336 |
| 13 | 1.35423 | .13405 | 6.25135 | .11174 | .98888 | -.09799 | .25410 | .17404 | .07524 | 2.15976 |
| 14 | 1.35373 | .13380 | 6.70657 | .12853 | .98650 | -.10140 | .25465 | .18119 | .06877 | 1.97138 |
| 15 | 1.35322 | .13355 | 7.14383 | .13668 | .98531 | -.10242 | .25522 | .18667 | .06397 | 1.83192 |
| 16 | 1.35191 | .13290 | 7.56151 | .13840 | .98515 | -.10156 | .25667 | .19137 | .06074 | 1.73756 |
| 17 | 1.34904 | .13149 | 7.95781 | .13495 | .98592 | -.09876 | .25986 | .19668 | .05852 | 1.67134 |
| 18 | 1.34420 | .12911 | 8.33075 | .12987 | .98691 | -.09555 | .26527 | .20302 | .05732 | 1.63335 |
| 19 | 1.33734 | .12575 | 8.67827 | .12653 | .98753 | -.09363 | .27297 | .21045 | .05715 | 1.62366 |
| 20 | 1.32846 | .12141 | 8.99827 | .12463 | .98788 | -.09257 | .28303 | .21972 | .05734 | 1.62233 |
| 21 | 1.31807 | .11638 | 9.28871 | .12568 | .98764 | -.09361 | .29490 | .22963 | .05851 | 1.64745 |
| 22 | 1.30823 | .11164 | 9.54755 | .14293 | .98424 | -.10393 | .30626 | .23957 | .05920 | 1.65845 |
| 23 | 1.30024 | .10781 | 9.77304 | .15779 | .98099 | -.11301 | .31558 | .24767 | .05981 | 1.66811 |
| 24 | 1.29246 | .10410 | 9.96424 | .15593 | .98141 | -.11164 | .32471 | .25642 | .05967 | 1.65641 |
| 25 | 1.28074 | .09856 | 10.12055 | .12981 | .98679 | -.09384 | .33861 | .27229 | .05721 | 1.57467 |
| 26 | 1.25716 | .08758 | 10.24166 | .05575 | .99562 | -.04467 | .36703 | .30283 | .05404 | 1.45973 |
| 27 | 1.20739 | .06529 | 10.32735 | -.16695 | .96399 | .10139 | .42908 | .36493 | .05150 | 1.32289 |
| 28 | 1.20150 | .06275 | 10.37540 | -.62860 | .52553 | .40433 | .43659 | .37473 | .04936 | 1.25731 |
| 29 | 1.61565 | .26744 | 10.38560 | -.38400 | .20780 | .24799 | .00353 | -.02735 | .03890 | 1.14905 |
| 30 | 1.96022 | .44117 | 10.36018 | .65084 | .59830 | -.42292 | -.22031 | -.23334 | .02643 | .73396 |
| 31 | 2.15899 | .53515 | 10.29171 | .46471 | .83246 | -.30126 | -.30667 | -.29825 | -.02226 | -.58705 |
| 32 | 2.19970 | .55370 | 10.18400 | .37587 | .89387 | -.24233 | -.32134 | -.31531 | -.01703 | -.44300 |
| 33 | 2.20154 | .55453 | 10.03923 | .31313 | .92807 | -.20007 | -.32198 | -.31824 | -.01064 | -.27636 |
| 34 | 2.20389 | .55560 | 9.85887 | .27212 | .94661 | -.17173 | -.32280 | -.32144 | -.00389 | -.10080 |
| 35 | 2.20912 | .55796 | 9.64427 | .23800 | .95975 | -.14801 | -.32460 | -.32561 | .00294 | .07594 |
| 36 | 2.20132 | .55443 | 9.39683 | .20630 | .97014 | -.12673 | -.32190 | -.32485 | .00852 | .22053 |
| 37 | 2.17504 | .54249 | 9.11869 | .19257 | .97437 | -.11624 | -.31256 | -.31764 | .01414 | .36877 |
| 38 | 2.14290 | .52775 | 8.81273 | .18890 | .97563 | -.11167 | -.30061 | -.30797 | .01958 | .51567 |
| 39 | 2.11348 | .51413 | 8.48092 | .18460 | .97704 | -.10634 | -.28914 | -.29934 | .02608 | .69247 |
| 40 | 2.08811 | .50227 | 8.12516 | .18345 | .97777 | -.10150 | -.27883 | -.29306 | .03527 | .94246 |
| 41 | 2.06586 | .49181 | 7.74731 | .17991 | .97909 | -.09491 | -.26944 | -.28835 | .04564 | 1.22598 |
| 42 | 2.03820 | .47869 | 7.34919 | .17487 | .98069 | -.08738 | -.25732 | -.28154 | .05650 | 1.52788 |
| 43 | 1.96594 | .44395 | 6.93251 | .16447 | .98325 | -.07816 | -.22318 | -.25416 | .06522 | 1.79863 |
| 44 | 1.92165 | .42232 | 6.49869 | .14812 | .98659 | -.06763 | -.20035 | -.23684 | .07226 | 2.01482 |
| 45 | 1.92377 | .42336 | 6.04916 | .12458 | .99056 | -.05558 | -.20148 | -.24074 | .07836 | 2.18191 |
| 46 | 1.91404 | .41858 | 5.58543 | .09586 | .99434 | -.04253 | -.19628 | -.23867 | .08373 | 2.33554 |
| 47 | 1.89847 | .41090 | 5.10904 | .06090 | .99756 | -.02825 | -.18780 | -.23366 | .08884 | 2.48655 |
| 48 | 1.88047 | .40199 | 4.62161 | .02139 | .99945 | -.01355 | -.17776 | -.22742 | .09403 | 2.64197 |
| 49 | 1.86139 | .39251 | 4.12484 | -.02459 | .99935 | .00137 | -.16683 | -.22016 | .09852 | 2.77972 |
| 50 | 1.84099 | .38232 | 3.62021 | -.07698 | .99658 | .01609 | -.15479 | -.21168 | .10228 | 2.89850 |
| 51 | 1.82107 | .37233 | 3.10950 | -.12507 | .99155 | .02833 | -.14270 | -.20325 | .10604 | 3.01757 |
| 52 | 1.80472 | .36410 | 2.59463 | -.16114 | .98619 | .03647 | -.13252 | -.19615 | .10908 | 3.11440 |
| 53 | 1.79323 | .35831 | 2.07721 | -.18203 | .98243 | .04095 | -.12522 | -.19132 | .11166 | 3.19509 |
| 54 | 1.78619 | .35474 | 1.55841 | -.18762 | .98129 | .04315 | -.12069 | -.18908 | .11460 | 3.28324 |
| 55 | 1.78243 | .35284 | 1.03896 | -.18268 | .98218 | .04415 | -.11825 | -.18849 | .11729 | 3.36194 |
| 56 | 1.78075 | .35199 | .51936 | -.17577 | .98340 | .04502 | -.11716 | -.18894 | .11978 | 3.43355 |
| 57 | 1.78031 | .35177 | .00000 | -.17358 | .98373 | .04629 | -.11687 | -.19012 | .12238 | 3.50743 |
| I | MCON | NUCON | YIN | DNY | DNZ | DNX | CPP | CPNC | DELMCH | DELNUD |

DELTA CP FROM NON CONICAL CORRECTION

| I | ETASPN | CPU | CPL | DELTACP |
|---|---|---|---|---|
| 1 | .0000 | -.1901 | .1110 | .3011 |
| 2 | .0500 | -.1889 | .1132 | .3021 |
| 3 | .1000 | -.1885 | .1162 | .3047 |
| 4 | .1501 | -.1891 | .1198 | .3089 |
| 5 | .2000 | -.1913 | .1239 | .3153 |
| 6 | .2498 | -.1961 | .1292 | .3254 |
| 7 | .2994 | -.2032 | .1349 | .3382 |
| 8 | .3486 | -.2117 | .1404 | .3521 |
| 9 | .3972 | -.2202 | .1464 | .3665 |
| 10 | .4450 | -.2274 | .1520 | .3794 |
| 11 | .4919 | -.2337 | .1576 | .3913 |
| 12 | .5378 | -.2387 | .1640 | .4027 |
| 13 | .5825 | -.2407 | .1709 | .4117 |
| 14 | .6257 | -.2368 | .1779 | .4148 |
| 15 | .6675 | -.2542 | .1840 | .4382 |
| 16 | .7076 | -.2815 | .1890 | .4705 |
| 17 | .7460 | -.2884 | .1939 | .4822 |
| 18 | .7823 | -.2931 | .1995 | .4926 |
| 19 | .8166 | -.2993 | .2062 | .5056 |
| 20 | .8486 | -.3080 | .2143 | .5223 |
| 21 | .8780 | -.3176 | .2238 | .5415 |
| 22 | .9048 | -.3248 | .2338 | .5586 |
| 23 | .9286 | -.3256 | .2430 | .5687 |
| 24 | .9493 | -.3214 | .2516 | .5730 |
| 25 | .9666 | -.3182 | .2640 | .5823 |
| 26 | .9806 | -.3153 | .2883 | .6036 |
| 27 | .9910 | -.2983 | .3391 | .6374 |
| 28 | .9976 | -.2333 | .3716 | .6050 |
| 29 | 1.0000 | -.0274 | -.0274 | 0.0000 |
| I | ETASPN | CPU | CPL | DELTACP |

NON-CONICAL FORCE RESULTS

CN= .4102

PURE CONICAL FORCE COEFFICIENT RESULTS

CN (FROM DELTA CP ) = .4595 CN (FROM SPANLOAD) =, .4595

SPAN E= .8774

CL= .45353

CD= .06841

CN= .45784 CA= -.02737

A = .6612

EMINF= 1.6200 ALP=12.0000

JOBN

COREL ANALYSIS FINISHED

GRUMMAN W12SC3
PROGRAM STARTS

LIST OF INPUT CARDS

```
00000000011111111112222222222333333333344444444445555555555666666666677777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890

 SC3 DEMO  WING ALONE FOR COMBINED ANALYSIS DESIGN-CRAIDON GEOMETRY
  0  1  0  0  0  0  0 20 30
  0.0     0.147  0.586  1.317  2.338  3.645  5.235  7.102  9.242 11.649
 14.314 17.231 20.391 23.784 27.400 31.230 35.261 39.483 43.881 48.445
 53.159 58.011 62.986 68.070 73.247 78.503 83.822 89.188 94.586100.000
-0.0000 0.0     0.0    23.8401
 1.6587 0.7735-0.165622.3368
 3.3171 1.5471-0.272320.8338
 4.9747 2.3206-0.334119.3317
 6.6296 3.0941-0.361617.8324
 8.2770 3.8676-0.363716.3413
 9.9051 4.6412-0.348414.8714
11.4905 5.4147-0.323313.4495
13.0004 6.1882-0.295512.1174
14.4103 6.9617-0.278110.9170
15.7249 7.7353-0.2864 9.8687
16.9739 8.5088-0.2616 8.9614
18.1883 9.2823-0.2386 8.1602
19.387910.0558-0.2230 7.4225
20.581910.8294-0.2179 6.7156
21.773911.6029-0.2164 6.0212
22.965312.3764-0.2192 5.3313
24.156613.1499-0.2286 4.6430
25.357313.9235-0.2459 3.9456
27.500014.6970-0.1566 2.3063
  0.0     0.0000 0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  0.0     0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  0.0     0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0000
  0.0     0.0085 0.0310 0.0615 0.0962 0.1328 0.1684 0.2006 0.2279 0.2500
  0.2665 0.2780 0.2857 0.2908 0.2942 0.2963 0.2977 0.2986 0.2991 0.2994
  0.2995 0.2995 0.2995 0.2993 0.2992 0.2990 0.2989 0.2987 0.2986 0.2986
  0.0    0.0073 0.0281 0.0593 0.0972 0.1396 0.1851 0.2323 0.2793 0.3245
  0.3662 0.4037 0.4365 0.4647 0.4880 0.5061 0.5200 0.5302 0.5377 0.5428
  0.5461 0.5480 0.5488 0.5488 0.5482 0.5473 0.5462 0.5451 0.5442 0.5433
  0.0    0.0063 0.0247 0.0533 0.0898 0.1317 0.1777 0.2269 0.2784 0.3310
  0.3834 0.4344 0.4827 0.5276 0.5685 0.6054 0.6381 0.6669 0.6909 0.7101
  0.7250 0.7360 0.7436 0.7484 0.7511 0.7521 0.7521 0.7517 0.7509 0.7500
  0.0    0.0055 0.0214 0.0469 0.0802 0.1196 0.1634 0.2109 0.2613 0.3140
  0.3684 0.4235 0.4784 0.5321 0.5838 0.6329 0.6788 0.7214 0.7603 0.7953
  0.8262 0.8516 0.8715 0.8865 0.8974 0.9050 0.9104 0.9142 0.9167 0.9181
  0.0    0.0047 0.0185 0.0409 0.0706 0.1064 0.1470 0.1913 0.2388 0.2889
  0.3415 0.3959 0.4516 0.5081 0.5645 0.6202 0.6744 0.7265 0.7757 0.8212
  0.8625 0.8993 0.9315 0.9589 0.9810 0.9989 1.0135 1.0251 1.0344 1.0416
  0.0    0.0041 0.0160 0.0355 0.0618 0.0939 0.1308 0.1715 0.2155 0.2622
  0.3115 0.3633 0.4172 0.4729 0.5300 0.5877 0.6453 0.7019 0.7564 0.8080
  0.8559 0.8996 0.9390 0.9740 1.0053 1.0337 1.0590 1.0807 1.0992 1.1149
  0.0    0.0035 0.0140 0.0310 0.0542 0.0829 0.1162 0.1535 0.1940 0.2373
  0.2832 0.3317 0.3826 0.4357 0.4907 0.5470 0.6038 0.6603 0.7156 0.7689
  0.8193 0.8665 0.9101 0.9505 0.9881 1.0230 1.0552 1.0848 1.1119 1.1367
```

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.0031 | 0.0123 | 0.0275 | 0.0482 | 0.0739 | 0.1041 | 0.1382 | 0.1755 | 0.2155 |
| 0.2580 | 0.3029 | 0.3500 | 0.3992 | 0.4502 | 0.5026 | 0.5557 | 0.6090 | 0.6618 | 0.7134 |
| 0.7633 | 0.8109 | 0.8565 | 0.9003 | 0.9421 | 0.9816 | 1.0189 | 1.0539 | 1.0866 | 1.1170 |
| 0.0 | 0.0026 | 0.0105 | 0.0235 | 0.0413 | 0.0636 | 0.0902 | 0.1235 | 0.1613 | 0.2015 |
| 0.2423 | 0.2832 | 0.3260 | 0.3704 | 0.4163 | 0.4635 | 0.5116 | 0.5601 | 0.6086 | 0.6566 |
| 0.7037 | 0.7505 | 0.7966 | 0.8417 | 0.8855 | 0.9277 | 0.9683 | 1.0070 | 1.0438 | 1.0786 |
| 0.0 | 0.0031 | 0.0123 | 0.0276 | 0.0487 | 0.0750 | 0.1057 | 0.1396 | 0.1758 | 0.2132 |
| 0.2507 | 0.2876 | 0.3257 | 0.3650 | 0.4056 | 0.4472 | 0.4897 | 0.5327 | 0.5760 | 0.6199 |
| 0.6644 | 0.7093 | 0.7541 | 0.7987 | 0.8425 | 0.8855 | 0.9274 | 0.9679 | 1.0069 | 1.0444 |
| 0.0 | 0.0029 | 0.0114 | 0.0253 | 0.0443 | 0.0677 | 0.0950 | 0.1253 | 0.1578 | 0.1916 |
| 0.2257 | 0.2593 | 0.2926 | 0.3270 | 0.3622 | 0.3983 | 0.4351 | 0.4731 | 0.5125 | 0.5529 |
| 0.5942 | 0.6361 | 0.6785 | 0.7209 | 0.7632 | 0.8051 | 0.8463 | 0.8868 | 0.9262 | 0.9644 |
| 0.0 | 0.0025 | 0.0099 | 0.0220 | 0.0386 | 0.0590 | 0.0830 | 0.1096 | 0.1384 | 0.1685 |
| 0.1992 | 0.2295 | 0.2590 | 0.2885 | 0.3193 | 0.3514 | 0.3847 | 0.4192 | 0.4549 | 0.4917 |
| 0.5294 | 0.5678 | 0.6068 | 0.6462 | 0.6857 | 0.7253 | 0.7645 | 0.8034 | 0.8416 | 0.8790 |
| 0.0 | 0.0021 | 0.0085 | 0.0188 | 0.0330 | 0.0506 | 0.0712 | 0.0942 | 0.1193 | 0.1458 |
| 0.1734 | 0.2015 | 0.2294 | 0.2568 | 0.2848 | 0.3139 | 0.3441 | 0.3753 | 0.4074 | 0.4405 |
| 0.4744 | 0.5090 | 0.5443 | 0.5800 | 0.6161 | 0.6523 | 0.6886 | 0.7247 | 0.7605 | 0.7958 |
| 0.0 | 0.0018 | 0.0073 | 0.0163 | 0.0287 | 0.0442 | 0.0624 | 0.0832 | 0.1060 | 0.1304 |
| 0.1561 | 0.1824 | 0.2089 | 0.2351 | 0.2608 | 0.2871 | 0.3142 | 0.3420 | 0.3707 | 0.4001 |
| 0.4302 | 0.4610 | 0.4923 | 0.5241 | 0.5563 | 0.5887 | 0.6213 | 0.6538 | 0.6863 | 0.7185 |
| 0.0 | 0.0016 | 0.0064 | 0.0144 | 0.0253 | 0.0390 | 0.0552 | 0.0738 | 0.0942 | 0.1163 |
| 0.1396 | 0.1638 | 0.1885 | 0.2132 | 0.2375 | 0.2613 | 0.2854 | 0.3101 | 0.3354 | 0.3612 |
| 0.3876 | 0.4145 | 0.4419 | 0.4696 | 0.4977 | 0.5260 | 0.5545 | 0.5831 | 0.6117 | 0.6401 |
| 0.0 | 0.0014 | 0.0056 | 0.0124 | 0.0219 | 0.0338 | 0.0480 | 0.0642 | 0.0822 | 0.1018 |
| 0.1226 | 0.1444 | 0.1667 | 0.1894 | 0.2120 | 0.2344 | 0.2561 | 0.2777 | 0.2997 | 0.3221 |
| 0.3449 | 0.3681 | 0.3916 | 0.4154 | 0.4394 | 0.4636 | 0.4879 | 0.5124 | 0.5368 | 0.5612 |
| 0.0 | 0.0012 | 0.0047 | 0.0105 | 0.0185 | 0.0287 | 0.0408 | 0.0547 | 0.0702 | 0.0871 |
| 0.1052 | 0.1243 | 0.1441 | 0.1643 | 0.1847 | 0.2051 | 0.2252 | 0.2449 | 0.2639 | 0.2831 |
| 0.3025 | 0.3221 | 0.3420 | 0.3620 | 0.3821 | 0.4024 | 0.4227 | 0.4431 | 0.4634 | 0.4837 |
| 0.0 | 0.0010 | 0.0038 | 0.0085 | 0.0151 | 0.0233 | 0.0332 | 0.0446 | 0.0574 | 0.0714 |
| 0.0864 | 0.1024 | 0.1192 | 0.1365 | 0.1543 | 0.1723 | 0.1905 | 0.2085 | 0.2262 | 0.2434 |
| 0.2597 | 0.2760 | 0.2924 | 0.3088 | 0.3253 | 0.3419 | 0.3584 | 0.3749 | 0.3914 | 0.4078 |
| 0.0 | 0.0004 | 0.0016 | 0.0036 | 0.0064 | 0.0100 | 0.0144 | 0.0195 | 0.0253 | 0.0318 |
| 0.0389 | 0.0467 | 0.0551 | 0.0640 | 0.0734 | 0.0833 | 0.0936 | 0.1043 | 0.1154 | 0.1267 |
| 0.1355 | 0.1444 | 0.1533 | 0.1624 | 0.1715 | 0.1806 | 0.1898 | 0.1990 | 0.2082 | 0.2173 |
| 0.0 | 0.1866 | 0.3670 | 0.5412 | 0.7088 | 0.8696 | 1.0230 | 1.1685 | 1.3057 | 1.4337 |
| 1.5517 | 1.6588 | 1.7539 | 1.8357 | 1.9029 | 1.9538 | 1.9867 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.2168 | 0.4199 | 0.6094 | 0.7856 | 0.9490 | 1.1001 | 1.2393 | 1.3674 | 1.4845 |
| 1.5912 | 1.6873 | 1.7727 | 1.8466 | 1.9081 | 1.9555 | 1.9870 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.2432 | 0.4660 | 0.6689 | 0.8527 | 1.0184 | 1.1674 | 1.3012 | 1.4212 | 1.5290 |
| 1.6257 | 1.7122 | 1.7891 | 1.8561 | 1.9126 | 1.9571 | 1.9872 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.2657 | 0.5054 | 0.7197 | 0.9099 | 1.0776 | 1.2249 | 1.3540 | 1.4672 | 1.5669 |
| 1.6551 | 1.7335 | 1.8031 | 1.8642 | 1.9165 | 1.9584 | 1.9874 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.2844 | 0.5381 | 0.7619 | 0.9574 | 1.1268 | 1.2726 | 1.3978 | 1.5054 | 1.5984 |
| 1.6795 | 1.7511 | 1.8147 | 1.8710 | 1.9198 | 1.9596 | 1.9876 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.2993 | 0.5640 | 0.7954 | 0.9951 | 1.1658 | 1.3104 | 1.4325 | 1.5357 | 1.6234 |
| 1.6989 | 1.7651 | 1.8239 | 1.8763 | 1.9223 | 1.9604 | 1.9878 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.3103 | 0.5833 | 0.8202 | 1.0231 | 1.1947 | 1.3385 | 1.4583 | 1.5581 | 1.6419 |
| 1.7133 | 1.7755 | 1.8307 | 1.8803 | 1.9242 | 1.9611 | 1.9879 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |
| 0.0 | 0.3174 | 0.5958 | 0.8363 | 1.0412 | 1.2135 | 1.3568 | 1.4751 | 1.5727 | 1.6539 |
| 1.7226 | 1.7822 | 1.8351 | 1.8829 | 1.9255 | 1.9615 | 1.9879 | 1.9998 | 1.9912 | 1.9587 |
| 1.9002 | 1.8141 | 1.6990 | 1.5539 | 1.3781 | 1.1712 | 0.9333 | 0.6649 | 0.3668 | 0.0400 |

```
0.0    0.3207 0.6016 0.8438 1.0496 1.2222 1.3652 1.4828 1.5795 1.6595
1.7269 1.7853 1.8372 1.8841 1.9260 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.3210 0.6020 0.8443 1.0503 1.2229 1.3658 1.4834 1.5800 1.6599
1.7273 1.7855 1.8373 1.8841 1.9261 1.9617 1.9880 1.9998 1.9912 1.9587
1.9002 1.8141 1.6990 1.5539 1.3781 1.1712 0.9333 0.6649 0.3668 0.0400
0.0    0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
AERO SECTION - DEMO WING - BASIC L.E.
 1  1 -2
 1  3  0  0  0  0  0 11 11
171.05 14.697 14.747 0.0    0.0    16.701  0.0
0.1224 0.1705 0.2189 0.2650 0.3066 0.3418 0.3691 0.3874 0.3960 0.3967
0.3967 0.3967 0.3967 0.3967 0.3967 0.3967 0.3967 0.3967 0.3967 0.0000
  0.00  10.00  20.00  30.00  40.00  50.00  60.00  70.00  80.00  90.00
100.00
0.0   1.4697  2.9394 4.4091 5.8788 7.3485 8.818210.287911.757613.2273
14.697
$AEROIN XLAMDA=57.0,NOPT(1)=2,NOPT(2)=-3,NOPT(4)=2,NOPT(5)=1,
NXSTNS=3,XSTN(1)=15.5,XSTN(2)=19.9,XSTN(3)=24.4,XAPEX=3.907,
 $END
1.6200 0.0000  .4000 0.0000
 M=1.62, ALPHA=12.0 , AZ=33.00  XSTN=19.90
29.000000 56.999999   .750000  3.907000  0.000000
   .000000    .301115
   .050007    .302098
   .100039    .304694
   .150055    .308909
   .200009    .315267
   .249829    .325394
   .299405    .338177
   .348580    .352118
```

CRAIDON DATA SET

1ST 4 LETTERS MUST BE AERO

W12SC3 DATA SET

END MUST BE IN COL. 3-5

$\eta_{DR}$

ORIGIN OF DIVIDING RAY

OUTPUT FROM COREL RUN, $\eta$ AND $\Delta C_p$.

$\Delta C_p$ IS FROM NON-CONICAL CORRECTION

| | |
|---|---|
| .397169 | .366539 |
| .445002 | .379375 |
| .491935 | .391259 |
| .537806 | .402665 |
| .582457 | .411663 |
| .625741 | .414758 |
| .667512 | .438176 |
| .707633 | .470520 |
| .745967 | .482211 |
| .782349 | .492589 |
| .816604 | .505572 |
| .848553 | .522309 |
| .878013 | .541463 |
| .904794 | .558632 |
| .928619 | .568655 |
| .949283 | .573043 |
| .966649 | .582279 |
| .980588 | .603604 |
| .990960 | .637355 |
| .997553 | .604970 |
| 1.000000 | 0.000000 |

```
00000000011111111112222222222333333333344444444445555555555666666666677777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

WING PANEL CORNER POINT COORDINATES
1 AND 3 INDICATE WING PANEL LEADING-EDGE POINTS, 2 AND 4 INDICATE TRAILING-EDGE POINTS

| PANEL | $X_1$ | $Y_1$ | $Z_1$ | $X_2$ | $Y_2$ | $Z_2$ | $X_3$ | $Y_3$ | $Z_3$ | $X_4$ | $Y_4$ | $Z_4$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00000 | 0.00000 | 0.00000 | 2.38401 | 0.00000 | 0.00000 | 3.15117 | 1.46970 | -.26162 | 5.24959 | 1.46970 | -.26162 |
| 2 | 2.38401 | 0.00000 | 0.00000 | 4.76802 | 0.00000 | 0.00000 | 5.24959 | 1.46970 | -.26162 | 7.34801 | 1.46970 | -.26162 |
| 3 | 4.76802 | 0.00000 | 0.00000 | 7.15203 | 0.00000 | 0.00000 | 7.34801 | 1.46970 | -.26162 | 9.44643 | 1.46970 | -.26162 |
| 4 | 7.15203 | 0.00000 | 0.00000 | 9.53604 | 0.00000 | 0.00000 | 9.44643 | 1.46970 | -.26162 | 11.54485 | 1.46970 | -.26162 |
| 5 | 9.53604 | 0.00000 | 0.00000 | 11.92005 | 0.00000 | 0.00000 | 11.54485 | 1.46970 | -.26162 | 13.64326 | 1.46970 | -.26162 |
| 6 | 11.92005 | 0.00000 | 0.00000 | 14.30406 | 0.00000 | 0.00000 | 13.64326 | 1.46970 | -.26162 | 15.74168 | 1.46970 | -.26162 |
| 7 | 14.30406 | 0.00000 | 0.00000 | 16.68807 | 0.00000 | 0.00000 | 15.74168 | 1.46970 | -.26162 | 17.84010 | 1.46970 | -.26162 |
| 8 | 16.68807 | 0.00000 | 0.00000 | 19.07208 | 0.00000 | 0.00000 | 17.84010 | 1.46970 | -.26162 | 19.93852 | 1.46970 | -.26162 |
| 9 | 19.07208 | 0.00000 | 0.00000 | 21.45609 | 0.00000 | 0.00000 | 19.93852 | 1.46970 | -.26162 | 22.03693 | 1.46970 | -.26162 |
| 10 | 21.45609 | 0.00000 | 0.00000 | 23.84010 | 0.00000 | 0.00000 | 22.03693 | 1.46970 | -.26162 | 24.13535 | 1.46970 | -.26162 |
| 11 | 3.15117 | 1.46970 | -.26162 | 5.24959 | 1.46970 | -.26162 | 6.29862 | 2.93940 | -.35610 | 8.11185 | 2.93940 | -.35610 |
| 12 | 5.24959 | 1.46970 | -.26162 | 7.34801 | 1.46970 | -.26162 | 8.11185 | 2.93940 | -.35610 | 9.92507 | 2.93940 | -.35610 |
| 13 | 7.34801 | 1.46970 | -.26162 | 9.44643 | 1.46970 | -.26162 | 9.92507 | 2.93940 | -.35610 | 11.73830 | 2.93940 | -.35610 |
| 14 | 9.44643 | 1.46970 | -.26162 | 11.54485 | 1.46970 | -.26162 | 11.73830 | 2.93940 | -.35610 | 13.55152 | 2.93940 | -.35610 |
| 15 | 11.54485 | 1.46970 | -.26162 | 13.64326 | 1.46970 | -.26162 | 13.55152 | 2.93940 | -.35610 | 15.36475 | 2.93940 | -.35610 |
| 16 | 13.64326 | 1.46970 | -.26162 | 15.74168 | 1.46970 | -.26162 | 15.36475 | 2.93940 | -.35610 | 17.17798 | 2.93940 | -.35610 |
| 17 | 15.74168 | 1.46970 | -.26162 | 17.84010 | 1.46970 | -.26162 | 17.17798 | 2.93940 | -.35610 | 18.99120 | 2.93940 | -.35610 |
| 18 | 17.84010 | 1.46970 | -.26162 | 19.93852 | 1.46970 | -.26162 | 18.99120 | 2.93940 | -.35610 | 20.80443 | 2.93940 | -.35610 |
| 19 | 19.93852 | 1.46970 | -.26162 | 22.03693 | 1.46970 | -.26162 | 20.80443 | 2.93940 | -.35610 | 22.61765 | 2.93940 | -.35610 |
| 20 | 22.03693 | 1.46970 | -.26162 | 24.13535 | 1.46970 | -.26162 | 22.61765 | 2.93940 | -.35610 | 24.43088 | 2.93940 | -.35610 |
| 21 | 6.29862 | 2.93940 | -.35610 | 8.11185 | 2.93940 | -.35610 | 9.41663 | 4.40910 | -.35299 | 10.94787 | 4.40910 | -.35299 |
| 22 | 8.11185 | 2.93940 | -.35610 | 9.92507 | 2.93940 | -.35610 | 10.94787 | 4.40910 | -.35299 | 12.47911 | 4.40910 | -.35299 |
| 23 | 9.92507 | 2.93940 | -.35610 | 11.73830 | 2.93940 | -.35610 | 12.47911 | 4.40910 | -.35299 | 14.01035 | 4.40910 | -.35299 |
| 24 | 11.73830 | 2.93940 | -.35610 | 13.55152 | 2.93940 | -.35610 | 14.01035 | 4.40910 | -.35299 | 15.54159 | 4.40910 | -.35299 |
| 25 | 13.55152 | 2.93940 | -.35610 | 15.36475 | 2.93940 | -.35610 | 15.54159 | 4.40910 | -.35299 | 17.07283 | 4.40910 | -.35299 |
| 26 | 15.36475 | 2.93940 | -.35610 | 17.17798 | 2.93940 | -.35610 | 17.07283 | 4.40910 | -.35299 | 18.60407 | 4.40910 | -.35299 |
| 27 | 17.17798 | 2.93940 | -.35610 | 18.99120 | 2.93940 | -.35610 | 18.60407 | 4.40910 | -.35299 | 20.13531 | 4.40910 | -.35299 |
| 28 | 18.99120 | 2.93940 | -.35610 | 20.80443 | 2.93940 | -.35610 | 20.13531 | 4.40910 | -.35299 | 21.66655 | 4.40910 | -.35299 |
| 29 | 20.80443 | 2.93940 | -.35610 | 22.61765 | 2.93940 | -.35610 | 21.66655 | 4.40910 | -.35299 | 23.19780 | 4.40910 | -.35299 |
| 30 | 22.61765 | 2.93940 | -.35610 | 24.43088 | 2.93940 | -.35610 | 23.19780 | 4.40910 | -.35299 | 24.7[illegible]4 | 4.40910 | -.35299 |
| 31 | 9.41663 | 4.40910 | -.35299 | 10.94787 | 4.40910 | -.35299 | 12.39644 | 5.87880 | -.30662 | 13.66146 | 5.87880 | -.30662 |
| 32 | 10.94787 | 4.40910 | -.35299 | 12.47911 | 4.40910 | -.35299 | 13.66146 | 5.87880 | -.30662 | 14.92649 | 5.87880 | -.30662 |
| 33 | 12.47911 | 4.40910 | -.35299 | 14.01035 | 4.40910 | -.35299 | 14.92649 | 5.87880 | -.30662 | 16.19151 | 5.87880 | -.30662 |
| 34 | 14.01035 | 4.40910 | -.35299 | 15.54159 | 4.40910 | -.35299 | 16.19151 | 5.87880 | -.30662 | 17.45654 | 5.87880 | -.30662 |
| 35 | 15.54159 | 4.40910 | -.35299 | 17.07283 | 4.40910 | -.35299 | 17.45654 | 5.87880 | -.30662 | 18.72156 | 5.87880 | -.30662 |
| 36 | 17.07283 | 4.40910 | -.35299 | 18.60407 | 4.40910 | -.35299 | 18.72156 | 5.87880 | -.30662 | 19.98658 | 5.87880 | -.30662 |
| 37 | 18.60407 | 4.40910 | -.35299 | 20.13531 | 4.40910 | -.35299 | 19.98658 | 5.87880 | -.30662 | 21.25161 | 5.87880 | -.30662 |
| 38 | 20.13531 | 4.40910 | -.35299 | 21.66655 | 4.40910 | -.35299 | 21.25161 | 5.87880 | -.30662 | 22.51663 | 5.87880 | -.30662 |
| 39 | 21.66655 | 4.40910 | -.35299 | 23.19780 | 4.40910 | -.35299 | 22.51663 | 5.87880 | -.30662 | 23.78166 | 5.87880 | -.30662 |
| 40 | 23.19780 | 4.40910 | -.35299 | 24.72904 | 4.40910 | -.35299 | 23.78166 | 5.87880 | -.30662 | 25.04668 | 5.87880 | -.30662 |
| 41 | 12.39644 | 5.87880 | -.30662 | 13.66146 | 5.87880 | -.30662 | 15.06760 | 7.34850 | -.28225 | 16.10689 | 7.34850 | -.28225 |
| 42 | 13.66146 | 5.87880 | -.30662 | 14.92649 | 5.87880 | -.30662 | 16.10689 | 7.34850 | -.28225 | 17.14617 | 7.34850 | -.28225 |
| 43 | 14.92649 | 5.87880 | -.30662 | 16.19151 | 5.87880 | -.30662 | 17.14617 | 7.34850 | -.28225 | 18.18546 | 7.34850 | -.28225 |
| 44 | 16.19151 | 5.87880 | -.30662 | 17.45654 | 5.87880 | -.30662 | 18.18546 | 7.34850 | -.28225 | 19.22474 | 7.34850 | -.28225 |
| 45 | 17.45654 | 5.87880 | -.30662 | 18.72156 | 5.87880 | -.30662 | 19.22474 | 7.34850 | -.28225 | 20.26403 | 7.34850 | -.28225 |
| 46 | 18.72156 | 5.87880 | -.30662 | 19.98658 | 5.87880 | -.30662 | 20.26403 | 7.34850 | -.28225 | 21.30331 | 7.34850 | -.28225 |
| 47 | 19.98658 | 5.87880 | -.30662 | 21.25161 | 5.87880 | -.30662 | 21.30331 | 7.34850 | -.28225 | 22.34260 | 7.34850 | -.28225 |
| 48 | 21.25161 | 5.87880 | -.30662 | 22.51663 | 5.87880 | -.30662 | 22.34260 | 7.34850 | -.28225 | 23.38188 | 7.34850 | -.28225 |
| 49 | 22.51663 | 5.87880 | -.30662 | 23.78166 | 5.87880 | -.30662 | 23.38188 | 7.34850 | -.28225 | 24.42117 | 7.34850 | -.28225 |
| 50 | 23.78166 | 5.87880 | -.30662 | 25.04668 | 5.87880 | -.30662 | 24.42117 | 7.34850 | -.28225 | 25.46045 | 7.34850 | -.28225 |
| 51 | 15.06760 | 7.34850 | -.28225 | 16.10689 | 7.34850 | -.28225 | 17.45966 | 8.81820 | -.25240 | 18.32375 | 8.81820 | -.25240 |
| 52 | 16.10689 | 7.34850 | -.28225 | 17.14617 | 7.34850 | -.28225 | 18.32375 | 8.81820 | -.25240 | 19.18784 | 8.81820 | -.25240 |
| 53 | 17.14617 | 7.34850 | -.28225 | 18.18546 | 7.34850 | -.28225 | 19.18784 | 8.81820 | -.25240 | 20.05194 | 8.81820 | -.25240 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 54 | 18.18546 | 7.34850 | -.28225 | 19.22474 | 7.34850 | -.28225 | 20.05194 | 8.81820 | -.25240 | 20.91603 | 8.81820 | -.25240 |
| 55 | 19.22474 | 7.34850 | -.28225 | 20.26403 | 7.34850 | -.28225 | 20.91603 | 8.81820 | -.25240 | 21.78012 | 8.81820 | -.25240 |
| 56 | 20.26403 | 7.34850 | -.28225 | 21.30331 | 7.34850 | -.28225 | 21.78012 | 8.81820 | -.25240 | 22.64421 | 8.81820 | -.25240 |
| 57 | 21.30331 | 7.34850 | -.28225 | 22.34260 | 7.34850 | -.28225 | 22.64421 | 8.81820 | -.25240 | 23.50830 | 8.81820 | -.25240 |
| 58 | 22.34260 | 7.34850 | -.28225 | 23.38188 | 7.34850 | -.28225 | 23.50830 | 8.81820 | -.25240 | 24.37240 | 8.81820 | -.25240 |
| 59 | 23.38188 | 7.34850 | -.28225 | 24.42117 | 7.34850 | -.28225 | 24.37240 | 8.81820 | -.25240 | 25.23649 | 8.81820 | -.25240 |
| 60 | 24.42117 | 7.34850 | -.28225 | 25.46045 | 7.34850 | -.28225 | 25.23649 | 8.81820 | -.25240 | 26.10058 | 8.81820 | -.25240 |
| 61 | 17.45966 | 8.81820 | -.25240 | 18.32375 | 8.81820 | -.25240 | 19.74613 | 10.28790 | -.22147 | 20.46717 | 10.28790 | -.22147 |
| 62 | 18.32375 | 8.81820 | -.25240 | 19.18784 | 8.81820 | -.25240 | 20.46717 | 10.28790 | -.22147 | 21.18821 | 10.28790 | -.22147 |
| 63 | 19.18784 | 8.81820 | -.25240 | 20.05194 | 8.81820 | -.25240 | 21.18821 | 10.28790 | -.22147 | 21.90925 | 10.28790 | -.22147 |
| 64 | 20.05194 | 8.81820 | -.25240 | 20.91603 | 8.81820 | -.25240 | 21.90925 | 10.28790 | -.22147 | 22.63030 | 10.28790 | -.22147 |
| 65 | 20.91603 | 8.81820 | -.25240 | 21.78012 | 8.81820 | -.25240 | 22.63030 | 10.28790 | -.22147 | 23.35134 | 10.28790 | -.22147 |
| 66 | 21.78012 | 8.81820 | -.25240 | 22.64421 | 8.81820 | -.25240 | 23.35134 | 10.28790 | -.22147 | 24.07238 | 10.28790 | -.22147 |
| 67 | 22.64421 | 8.81820 | -.25240 | 23.50830 | 8.81820 | -.25240 | 24.07238 | 10.28790 | -.22147 | 24.79342 | 10.28790 | -.22147 |
| 68 | 23.50830 | 8.81820 | -.25240 | 24.37240 | 8.81820 | -.25240 | 24.79342 | 10.28790 | -.22147 | 25.51446 | 10.28790 | -.22147 |
| 69 | 24.37240 | 8.81820 | -.25240 | 25.23649 | 8.81820 | -.25240 | 25.51446 | 10.28790 | -.22147 | 26.23550 | 10.28790 | -.22147 |
| 70 | 25.23649 | 8.81820 | -.25240 | 26.10058 | 8.81820 | -.25240 | 26.23550 | 10.28790 | -.22147 | 26.95654 | 10.28790 | -.22147 |
| 71 | 19.74613 | 10.28790 | -.22147 | 20.46717 | 10.28790 | -.22147 | 22.01218 | 11.75760 | -.21696 | 22.60050 | 11.75760 | -.21696 |
| 72 | 20.46717 | 10.28790 | -.22147 | 21.18821 | 10.28790 | -.22147 | 22.60050 | 11.75760 | -.21696 | 23.18882 | 11.75760 | -.21696 |
| 73 | 21.18821 | 10.28790 | -.22147 | 21.90925 | 10.28790 | -.22147 | 23.18882 | 11.75760 | -.21696 | 23.77715 | 11.75760 | -.21696 |
| 74 | 21.90925 | 10.28790 | -.22147 | 22.63030 | 10.28790 | -.22147 | 23.77715 | 11.75760 | -.21696 | 24.36547 | 11.75760 | -.21696 |
| 75 | 22.63030 | 10.28790 | -.22147 | 23.35134 | 10.28790 | -.22147 | 24.36547 | 11.75760 | -.21696 | 24.95379 | 11.75760 | -.21696 |
| 76 | 23.35134 | 10.28790 | -.22147 | 24.07238 | 10.28790 | -.22147 | 24.95379 | 11.75760 | -.21696 | 25.54211 | 11.75760 | -.21696 |
| 77 | 24.07238 | 10.28790 | -.22147 | 24.79342 | 10.28790 | -.22147 | 25.54211 | 11.75760 | -.21696 | 26.13043 | 11.75760 | -.21696 |
| 78 | 24.79342 | 10.28790 | -.22147 | 25.51446 | 10.28790 | -.22147 | 26.13043 | 11.75760 | -.21696 | 26.71876 | 11.75760 | -.21696 |
| 79 | 25.51446 | 10.28790 | -.22147 | 26.23550 | 10.28790 | -.22147 | 26.71876 | 11.75760 | -.21696 | 27.30708 | 11.75760 | -.21696 |
| 80 | 26.23550 | 10.28790 | -.22147 | 26.95654 | 10.28790 | -.22147 | 27.30708 | 11.75760 | -.21696 | 27.89540 | 11.75760 | -.21696 |
| 81 | 22.01218 | 11.75760 | -.21696 | 22.60050 | 11.75760 | -.21696 | 24.27673 | 13.22730 | -.23033 | 24.73405 | 13.22730 | -.23033 |
| 82 | 22.60050 | 11.75760 | -.21696 | 23.18882 | 11.75760 | -.21696 | 24.73405 | 13.22730 | -.23033 | 25.19138 | 13.22730 | -.23033 |
| 83 | 23.18882 | 11.75760 | -.21696 | 23.77715 | 11.75760 | -.21696 | 25.19138 | 13.22730 | -.23033 | 25.64870 | 13.22730 | -.23033 |
| 84 | 23.77715 | 11.75760 | -.21696 | 24.36547 | 11.75760 | -.21696 | 25.64870 | 13.22730 | -.23033 | 26.10602 | 13.22730 | -.23033 |
| 85 | 24.36547 | 11.75760 | -.21696 | 24.95379 | 11.75760 | -.21696 | 26.10602 | 13.22730 | -.23033 | 26.56334 | 13.22730 | -.23033 |
| 86 | 24.95379 | 11.75760 | -.21696 | 25.54211 | 11.75760 | -.21696 | 26.56334 | 13.22730 | -.23033 | 27.02067 | 13.22730 | -.23033 |
| 87 | 25.54211 | 11.75760 | -.21696 | 26.13043 | 11.75760 | -.21696 | 27.02067 | 13.22730 | -.23033 | 27.47799 | 13.22730 | -.23033 |
| 88 | 26.13043 | 11.75760 | -.21696 | 26.71876 | 11.75760 | -.21696 | 27.47799 | 13.22730 | -.23033 | 27.93531 | 13.22730 | -.23033 |
| 89 | 26.71876 | 11.75760 | -.21696 | 27.30708 | 11.75760 | -.21696 | 27.93531 | 13.22730 | -.23033 | 28.39263 | 13.22730 | -.23033 |
| 90 | 27.30708 | 11.75760 | -.21696 | 27.89540 | 11.75760 | -.21696 | 28.39263 | 13.22730 | -.23033 | 28.84996 | 13.22730 | -.23033 |
| 91 | 24.27673 | 13.22730 | -.23033 | 24.73405 | 13.22730 | -.23033 | 27.50000 | 14.69700 | -.15660 | 27.73063 | 14.69700 | -.15660 |
| 92 | 24.73405 | 13.22730 | -.23033 | 25.19138 | 13.22730 | -.23033 | 27.73063 | 14.69700 | -.15660 | 27.96126 | 14.69700 | -.15660 |
| 93 | 25.19138 | 13.22730 | -.23033 | 25.64870 | 13.22730 | -.23033 | 27.96126 | 14.69700 | -.15660 | 28.19189 | 14.69700 | -.15660 |
| 94 | 25.64870 | 13.22730 | -.23033 | 26.10602 | 13.22730 | -.23033 | 28.19189 | 14.69700 | -.15660 | 28.42252 | 14.69700 | -.15660 |
| 95 | 26.10602 | 13.22730 | -.23033 | 26.56334 | 13.22730 | -.23033 | 28.42252 | 14.69700 | -.15660 | 28.65315 | 14.69700 | -.15660 |
| 96 | 26.56334 | 13.22730 | -.23033 | 27.02067 | 13.22730 | -.23033 | 28.65315 | 14.69700 | -.15660 | 28.88378 | 14.69700 | -.15660 |
| 97 | 27.02067 | 13.22730 | -.23033 | 27.47799 | 13.22730 | -.23033 | 28.88378 | 14.69700 | -.15660 | 29.11441 | 14.69700 | -.15660 |
| 98 | 27.47799 | 13.22730 | -.23033 | 27.93531 | 13.22730 | -.23033 | 29.11441 | 14.69700 | -.15660 | 29.34504 | 14.69700 | -.15660 |
| 99 | 27.93531 | 13.22730 | -.23033 | 28.39263 | 13.22730 | -.23033 | 29.34504 | 14.69700 | -.15660 | 29.57567 | 14.69700 | -.15660 |
| 100 | 28.39263 | 13.22730 | -.23033 | 28.84996 | 13.22730 | -.23033 | 29.57567 | 14.69700 | -.15660 | 29.80630 | 14.69700 | -.15660 |

WING PANEL EDGE POINTS ON CHORD PASSING THROUGH CENTROID, AND INCLINATION ANGLES

| POINT | $X_{CP}$ | $Y_{CP}$ | $Z_{CP}$ | THETA RAD | CAMBER SLOPE | THICKNESS SLOPE | THETA DEG |
|---|---|---|---|---|---|---|---|
| 1 | 1.54212 | .71924 | -.12803 | -.17617 | .24757 | .22476 | -10.09362 |
| 2 | 3.78637 | .71924 | -.12803 | -.17617 | .04066 | .05069 | -10.09362 |
| 3 | 6.03062 | .71924 | -.12803 | -.17617 | .00836 | .02517 | -10.09362 |
| 4 | 8.27486 | .71924 | -.12803 | -.17617 | .00204 | .01160 | -10.09362 |
| 5 | 10.51911 | .71924 | -.12803 | -.17617 | .00060 | -.00001 | -10.09362 |
| 6 | 12.76336 | .71924 | -.12803 | -.17617 | .00011 | -.01151 | -10.09362 |
| 7 | 15.00760 | .71924 | -.12803 | -.17617 | .00003 | -.02260 | -10.09362 |
| 8 | 17.25185 | .71924 | -.12803 | -.17617 | -.00007 | -.03327 | -10.09362 |
| 9 | 19.49610 | .71924 | -.12803 | -.17617 | -.00007 | -.04356 | -10.09362 |
| 10 | 21.74034 | .71924 | -.12803 | -.17617 | -.00012 | -.05342 | -10.09362 |
| 11 | 23.98459 | .71924 | -.12803 | -.17617 | .00004 | -.06293 | -10.09362 |
| 12 | 4.68665 | 2.18669 | -.30771 | -.06419 | .22607 | .24992 | -3.67804 |
| 13 | 6.64594 | 2.18669 | -.30771 | -.06419 | .11128 | .04370 | -3.67804 |
| 14 | 8.60523 | 2.18669 | -.30771 | -.06419 | .06991 | .02078 | -3.67804 |
| 15 | 10.56451 | 2.18669 | -.30771 | -.06419 | .04366 | .01040 | -3.67804 |
| 16 | 12.52380 | 2.18669 | -.30771 | -.06419 | .02720 | -.00001 | -3.67804 |
| 17 | 14.48309 | 2.18669 | -.30771 | -.06419 | .01483 | -.01151 | -3.67804 |
| 18 | 16.44238 | 2.18669 | -.30771 | -.06419 | .00694 | -.02260 | -3.67804 |
| 19 | 18.40166 | 2.18669 | -.30771 | -.06419 | .00234 | -.03327 | -3.67804 |
| 20 | 20.36095 | 2.18669 | -.30771 | -.06419 | -.00007 | -.04356 | -3.67804 |
| 21 | 22.32024 | 2.18669 | -.30771 | -.06419 | -.00070 | -.05342 | -3.67804 |
| 22 | 24.27952 | 2.18669 | -.30771 | -.06419 | -.00089 | -.06293 | -3.67804 |
| 23 | 7.81381 | 3.65360 | -.35459 | .00212 | .20064 | .26777 | .12123 |
| 24 | 9.49000 | 3.65360 | -.35459 | .00212 | .12746 | .03874 | .12123 |
| 25 | 11.16620 | 3.65360 | -.35459 | .00212 | .10248 | .01769 | .12123 |
| 26 | 12.84240 | 3.65360 | -.35459 | .00212 | .08301 | .00954 | .12123 |
| 27 | 14.51859 | 3.65360 | -.35459 | .00212 | .06598 | -.00002 | .12123 |
| 28 | 16.19479 | 3.65360 | -.35459 | .00212 | .05018 | -.01151 | .12123 |
| 29 | 17.87098 | 3.65360 | -.35459 | .00212 | .03549 | -.02260 | .12123 |
| 30 | 19.54718 | 3.65360 | -.35459 | .00212 | .02282 | -.03327 | .12123 |
| 31 | 21.22338 | 3.65360 | -.35459 | .00212 | .01444 | -.04356 | .12123 |
| 32 | 22.89957 | 3.65360 | -.35459 | .00212 | .00908 | -.05342 | .12123 |
| 33 | 24.57577 | 3.65360 | -.35459 | .00212 | .00526 | -.06293 | .12123 |
| 34 | 10.85925 | 5.12063 | -.33054 | .03154 | .18141 | .27824 | 1.80714 |
| 35 | 12.26161 | 5.12063 | -.33054 | .03154 | .13367 | .03582 | 1.80714 |
| 36 | 13.66397 | 5.12063 | -.33054 | .03154 | .11637 | .01587 | 1.80714 |
| 37 | 15.06632 | 5.12063 | -.33054 | .03154 | .10546 | .00903 | 1.80714 |
| 38 | 16.46868 | 5.12063 | -.33054 | .03154 | .09215 | -.00002 | 1.80714 |
| 39 | 17.87103 | 5.12063 | -.33054 | .03154 | .07651 | -.01151 | 1.80714 |
| 40 | 19.27339 | 5.12063 | -.33054 | .03154 | .06129 | -.02260 | 1.80714 |
| 41 | 20.67575 | 5.12063 | -.33054 | .03154 | .04951 | -.03327 | 1.80714 |
| 42 | 22.07810 | 5.12063 | -.33054 | .03154 | .04101 | -.04356 | 1.80714 |
| 43 | 23.48046 | 5.12063 | -.33054 | .03154 | .03315 | -.05342 | 1.80714 |
| 44 | 24.88282 | 5.12063 | -.33054 | .03154 | .02683 | -.06293 | 1.80714 |
| 45 | 13.68841 | 6.58965 | -.29483 | .01658 | .16756 | .28155 | .94997 |
| 46 | 14.84425 | 6.58965 | -.29483 | .01658 | .14700 | .03489 | .94997 |
| 47 | 16.00009 | 6.58965 | -.29483 | .01658 | .12221 | .01532 | .94997 |
| 48 | 17.15593 | 6.58965 | -.29483 | .01658 | .11226 | .00888 | .94997 |
| 49 | 18.31177 | 6.58965 | -.29483 | .01658 | .10195 | -.00003 | .94997 |
| 50 | 19.46761 | 6.58965 | -.29483 | .01658 | .09035 | -.01151 | .94997 |
| 51 | 20.62345 | 6.58965 | -.29483 | .01658 | .08084 | -.02260 | .94997 |
| 52 | 21.77929 | 6.58965 | -.29483 | .01658 | .07283 | -.03327 | .94997 |
| 53 | 22.93513 | 6.58965 | -.29483 | .01658 | .06498 | -.04356 | .94997 |
| 54 | 24.09097 | 6.58965 | -.29483 | .01658 | .05773 | -.05342 | .94997 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 55 | 25.24681 | 6.58965 | -.29483 | .01658 | .05104 | -.06293 | .94997 |
| 56 | 16.22693 | 8.06080 | -.26778 | .02031 | .21703 | .28166 | 1.16353 |
| 57 | 17.18131 | 8.06080 | -.26778 | .02031 | .15970 | .03486 | 1.16353 |
| 58 | 18.13569 | 8.06080 | -.26778 | .02031 | .11822 | .01531 | 1.16353 |
| 59 | 19.09006 | 8.06080 | -.26778 | .02031 | .10738 | .00886 | 1.16353 |
| 60 | 20.04444 | 8.06080 | -.26778 | .02031 | .10063 | -.00003 | 1.16353 |
| 61 | 20.99881 | 8.06080 | -.26778 | .02031 | .09681 | -.01151 | 1.16353 |
| 62 | 21.95319 | 8.06080 | -.26778 | .02031 | .09308 | -.02260 | 1.16353 |
| 63 | 22.90757 | 8.06080 | -.26778 | .02031 | .08834 | -.03327 | 1.16353 |
| 64 | 23.86194 | 8.06080 | -.26778 | .02031 | .08323 | -.04356 | 1.16353 |
| 65 | 24.81632 | 8.06080 | -.26778 | .02031 | .07774 | -.05342 | 1.16353 |
| 66 | 25.77069 | 8.06080 | -.26778 | .02031 | .07234 | -.06293 | 1.16353 |
| 67 | 18.56850 | 9.53094 | -.23740 | .02104 | .20328 | .28166 | 1.20562 |
| 68 | 19.36322 | 9.53094 | -.23740 | .02104 | .15367 | .03486 | 1.20562 |
| 69 | 20.15794 | 9.53094 | -.23740 | .02104 | .11183 | .01531 | 1.20562 |
| 70 | 20.95266 | 9.53094 | -.23740 | .02104 | .10228 | .00886 | 1.20562 |
| 71 | 21.74738 | 9.53094 | -.23740 | .02104 | .09938 | -,00003 | 1.20562 |
| 72 | 22.54210 | 9.53094 | -.23740 | .02104 | .09781 | -.01151 | 1.20562 |
| 73 | 23.33681 | 9.53094 | -.23740 | .02104 | .09602 | -.02260 | 1.20562 |
| 74 | 24.13153 | 9.53094 | -.23740 | .02104 | .09377 | -.03327 | 1.20562 |
| 75 | 24.92625 | 9.53094 | -.23740 | .02104 | .09116 | -.04356 | 1.20562 |
| 76 | 25.72097 | 9.53094 | -.23740 | .02104 | .08825 | -.05342 | 1.20562 |
| 77 | 26.51569 | 9.53094 | -.23740 | .02104 | .08473 | -.06293 | 1.20562 |
| 78 | 20.84087 | 10.99792 | -.21929 | .00307 | .18112 | .28166 | .17582 |
| 79 | 21.49780 | 10.99792 | -.21929 | .00307 | .15256 | .03486 | .17582 |
| 80 | 22.15472 | 10.99792 | -.21929 | .00307 | .12246 | .01531 | .17582 |
| 81 | 22.81164 | 10.99792 | -.21929 | .00307 | .10188 | .00886 | .17582 |
| 82 | 23.46857 | 10.99792 | -.21929 | .00307 | .09720 | -.00003 | .17582 |
| 83 | 24.12549 | 10.99792 | -.21929 | .00307 | .09473 | -.01151 | .17582 |
| 84 | 24.78242 | 10.99792 | -.21929 | .00307 | .09327 | -.02260 | .17582 |
| 85 | 25.43934 | 10.99792 | -.21929 | .00307 | .09219 | -.03327 | .17582 |
| 86 | 26.09626 | 10.99792 | -.21929 | .00307 | .09095 | -.04356 | .17582 |
| 87 | 26.75319 | 10.99792 | -.21929 | .00307 | .08952 | -.05342 | .17582 |
| 88 | 27.41011 | 10.99792 | -.21929 | .00307 | .08773 | -.06293 | .17582 |
| 89 | 23.09717 | 12.46176 | -.22337 | -.00910 | .17826 | .28166 | -.52125 |
| 90 | 23.62273 | 12.46176 | -.22337 | -.00910 | .15366 | .03486 | -.52125 |
| 91 | 24.14829 | 12.46176 | -.22337 | -.00910 | .13000 | .01531 | -.52125 |
| 92 | 24.67384 | 12.46176 | -.22337 | -.00910 | .10887 | .00886 | -.52125 |
| 93 | 25.19940 | 12.46176 | -.22337 | -.00910 | .09458 | -.00003 | -.52125 |
| 94 | 25.72496 | 12.46176 | -.22337 | -.00910 | .09069 | -.01151 | -.52125 |
| 95 | 26.25052 | 12.46176 | -.22337 | -.00910 | .08841 | -.02260 | -.52125 |
| 96 | 26.77607 | 12.46176 | -.22337 | -.00910 | .08665 | -.03327 | -.52125 |
| 97 | 27.30163 | 12.46176 | -.22337 | -.00910 | .08534 | -.04356 | -.52125 |
| 98 | 27.82719 | 12.46176 | -.22337 | -.00910 | .08463 | -.05342 | -.52125 |
| 99 | 28.35275 | 12.46176 | -.22337 | -.00910 | .08399 | -.06293 | -.52125 |
| 100 | 25.71135 | 13.88143 | -.19751 | .05013 | .17521 | .28166 | 2.87197 |
| 101 | 26.06777 | 13.88143 | -.19751 | .05013 | .14852 | .03486 | 2.87197 |
| 102 | 26.42420 | 13.88143 | -.19751 | .05013 | .13272 | .01531 | 2.87197 |
| 103 | 26.78062 | 13.88143 | -.19751 | .05013 | .11784 | .00886 | 2.87197 |
| 104 | 27.13705 | 13.88143 | -.19751 | .05013 | .10374 | -.00003 | 2.87197 |
| 105 | 27.49348 | 13.88143 | -.19751 | .05013 | .08835 | -.01151 | 2.87197 |
| 106 | 27.84990 | 13.88143 | -.19751 | .05013 | .08389 | -.02260 | 2.87197 |
| 107 | 28.20633 | 13.88143 | -.19751 | .05013 | .08100 | -.03327 | 2.87197 |
| 108 | 28.56275 | 13.88143 | -.19751 | .05013 | .07904 | -.04356 | 2.87197 |
| 109 | 28.91918 | 13.88143 | -.19751 | .05013 | .07786 | -.05342 | 2.87197 |
| 110 | 29.27560 | 13.88143 | -.19751 | .05013 | .07665 | -.06293 | 2.87197 |

## WING PANEL AREAS AND CHORDS

| PANEL | AREA | CHORD |
|---|---|---|
| 1 | 3.34569 | 2.24425 |
| 2 | 3.34569 | 2.24425 |
| 3 | 3.34569 | 2.24425 |
| 4 | 3.34569 | 2.24425 |
| 5 | 3.34569 | 2.24425 |
| 6 | 3.34569 | 2.24425 |
| 7 | 3.34569 | 2.24425 |
| 8 | 3.34569 | 2.24425 |
| 9 | 3.34569 | 2.24425 |
| 10 | 3.34569 | 2.24425 |
| 11 | 2.88040 | 1.95929 |
| 12 | 2.88040 | 1.95929 |
| 13 | 2.88040 | 1.95929 |
| 14 | 2.88040 | 1.95929 |
| 15 | 2.88040 | 1.95929 |
| 16 | 2.88040 | 1.95929 |
| 17 | 2.88040 | 1.95929 |
| 18 | 2.88040 | 1.95929 |
| 19 | 2.88040 | 1.95929 |
| 20 | 2.88040 | 1.95929 |
| 21 | 2.45769 | 1.67620 |
| 22 | 2.45769 | 1.67620 |
| 23 | 2.45769 | 1.67620 |
| 24 | 2.45769 | 1.67620 |
| 25 | 2.45769 | 1.67620 |
| 26 | 2.45769 | 1.67620 |
| 27 | 2.45769 | 1.67620 |
| 28 | 2.45769 | 1.67620 |
| 29 | 2.45769 | 1.67620 |
| 30 | 2.45769 | 1.67620 |
| 31 | 2.05586 | 1.40236 |
| 32 | 2.05586 | 1.40236 |
| 33 | 2.05586 | 1.40236 |
| 34 | 2.05586 | 1.40236 |
| 35 | 2.05586 | 1.40236 |
| 36 | 2.05586 | 1.40236 |
| 37 | 2.05586 | 1.40236 |
| 38 | 2.05586 | 1.40236 |
| 39 | 2.05586 | 1.40236 |
| 40 | 2.05586 | 1.40236 |
| 41 | 1.69355 | 1.15584 |
| 42 | 1.69355 | 1.15584 |
| 43 | 1.69355 | 1.15584 |
| 44 | 1.69355 | 1.15584 |
| 45 | 1.69355 | 1.15584 |
| 46 | 1.69355 | 1.15584 |
| 47 | 1.69355 | 1.15584 |
| 48 | 1.69355 | 1.15584 |
| 49 | 1.69355 | 1.15584 |
| 50 | 1.69355 | 1.15584 |
| 51 | 1.39899 | .95438 |
| 52 | 1.39899 | .95438 |
| 53 | 1.39899 | .95438 |
| 54 | 1.39899 | .95438 |
| 55 | 1.39899 | .95438 |
| 56 | 1.39899 | .95438 |
| 57 | 1.39899 | .95438 |

| | | |
|---|---|---|
| 58 | 1.39899 | .95438 |
| 59 | 1.39899 | .95438 |
| 60 | 1.39899 | .95438 |
| 61 | 1.16509 | .79472 |
| 62 | 1.16509 | .79472 |
| 63 | 1.16509 | .79472 |
| 64 | 1.16509 | .79472 |
| 65 | 1.16509 | .79472 |
| 66 | 1.16509 | .79472 |
| 67 | 1.16509 | .79472 |
| 68 | 1.16509 | .79472 |
| 69 | 1.16509 | .79472 |
| 70 | 1.16509 | .79472 |
| 71 | .96219 | .65692 |
| 72 | .96219 | .65692 |
| 73 | .96219 | .65692 |
| 74 | .96219 | .65692 |
| 75 | .96219 | .65692 |
| 76 | .96219 | .65692 |
| 77 | .96219 | .65692 |
| 78 | .96219 | .65692 |
| 79 | .96219 | .65692 |
| 80 | .96219 | .65692 |
| 81 | .76842 | .52556 |
| 82 | .76842 | .52556 |
| 83 | .76842 | .52556 |
| 84 | .76842 | .52556 |
| 85 | .76842 | .52556 |
| 86 | .76842 | .52556 |
| 87 | .76842 | .52556 |
| 88 | .76842 | .52556 |
| 89 | .76842 | .52556 |
| 90 | .76842 | .52556 |
| 91 | .50618 | .35643 |
| 92 | .50618 | .35643 |
| 93 | .50618 | .35643 |
| 94 | .50618 | .35643 |
| 95 | .50618 | .35643 |
| 96 | .50618 | .35643 |
| 97 | .50618 | .35643 |
| 98 | .50618 | .35643 |
| 99 | .50618 | .35643 |
| 100 | .50618 | .35643 |

ECHO OF W12 CONTROL BLOCK NAMELIST

```
$AEROIN
NOPT     = 2, -3, 0, 2, 1, 0, 0, 0, 0, 0,
NXSTNS   = 3,
XSTN     = .155E+02, .199E+02, .244E+02, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
           0.0, 0.0,
XAPEX    = .3907E+01,
YAPEX    = 0.0,
XLAMDA   = .57E+02,
$END


IPART=      1
NWING=   100  NCPT=   110  NSEG=    10
NROW(N),N=1,  10
    10    10    10    10    10    10    10    10    10    10
NCOL(N),N=1,  10
     1     1     1     1     1     1     1     1     1     1

PARTITION =  5  TIME = 214.94400
INFLUENCE OF WING ON WING

END OF AIC CALCULATIONS, TIME = 249.42000

NBODY=      0
NBBLOK=      1

IPART=      1
NWING=   100  NCPT=   110  NSEG=    10
NROW(N),N=1,  10
    10    10    10    10    10    10    10    10    10    10
NCOL(N),N=1,  10
     1     1     1     1     1     1     1     1     1     1
NWBLOK=    10

IPART=      2
NWING=     0  NCPT=     0  NSEG=     0
NWBLOK=      1
VELCMP, TIME = 249.77200
```

**1st DEPARTURE FROM USSAERO**

WING/BODY SOLUTION

CONICAL CAMBER PANEL DESIGN

INPUT M=1.62, ALPHA=12.0 , AZ=33.00 XSTN=19.90

| FCCCC | XLAMLE | ETADR | XORIGC | YORIGC |
|---|---|---|---|---|
| 29.00000 | 57.00000 | .75000 | 3.90700 | 0.00000 |

| ETA | DCP |
|---|---|
| 0.00000 | .30112 |
| .05001 | .30210 |
| .10004 | .30469 |
| .15006 | .30891 |
| .20001 | .31527 |
| .24983 | .32539 |
| .29941 | .33818 |
| .34858 | .35212 |
| .39717 | .36654 |
| .44500 | .37938 |
| .49194 | .39126 |
| .53781 | .40267 |
| .58246 | .41166 |
| .62574 | .41476 |
| .66751 | .43818 |
| .70763 | .47052 |
| .74597 | .48221 |
| .78235 | .49259 |
| .81660 | .50557 |
| .84855 | .52231 |
| .87801 | .54146 |
| .90479 | .55863 |
| .92862 | .56866 |
| .94928 | .57304 |
| .96665 | .58228 |
| .98059 | .60360 |
| .99096 | .63736 |
| .99755 | .60497 |
| 1.00000 | 0.00000 |

| PANEL | X | Y | ETA | PRESSURE |
|---|---|---|---|---|
| 1 | 3.67416 | .71924 | 1.00000 | .00000 |
| 2 | 5.91841 | .71924 | .55063 | |
| 3 | 8.16265 | .71924 | .26025 | |
| 4 | 10.40690 | .71924 | .17039 | |
| 5 | 12.65115 | .71924 | .12666 | |
| 6 | 14.89539 | .71924 | .10079 | |
| 7 | 17.13964 | .71924 | .08370 | |
| 8 | 19.38389 | .71924 | .07156 | |
| 9 | 21.62813 | .71924 | .06250 | |
| 10 | 23.87238 | .71924 | .05547 | |

**IF $\eta < \eta_{DR}$, PRESSURE IS NOT SPECIFIED ON THE PANEL. IF $\eta > \eta_{DR}$, THE INTERPOLATED VALUE OF $\Delta c_p$ IS PRESCRIBED.**

| | | | | |
|---|---|---|---|---|
| 11 | 6.54797 | 2.18669 | 1.00000 | .00000 |
| 12 | 8.50726 | 2.18669 | .73196 | |
| 13 | 10.46655 | 2.18669 | .51333 | |
| 14 | 12.42584 | 2.18669 | .39527 | |
| 15 | 14.38512 | 2.18669 | .32136 | |
| 16 | 16.34441 | 2.18669 | .27073 | |
| 17 | 18.30370 | 2.18669 | .23389 | |
| 18 | 20.26299 | 2.18669 | .20587 | |
| 19 | 22.22227 | 2.18669 | .18385 | |
| 20 | 24.18156 | 2.18669 | .16608 | |
| 21 | 9.40619 | 3.65360 | 1.00000 | .00000 |
| 22 | 11.08239 | 3.65360 | .78408 | .49324 |
| 23 | 12.75859 | 3.65360 | .63560 | |
| 24 | 14.43478 | 3.65360 | .53440 | |
| 25 | 16.11098 | 3.65360 | .46100 | |
| 26 | 17.78717 | 3.65360 | .40533 | |
| 27 | 19.46337 | 3.65360 | .36166 | |
| 28 | 21.13957 | 3.65360 | .32648 | |
| 29 | 22.81576 | 3.65360 | .29754 | |
| 30 | 24.49196 | 3.65360 | .27331 | |
| 31 | 12.19149 | 5.12063 | .95179 | .57438 |
| 32 | 13.59385 | 5.12063 | .81400 | .50458 |
| 33 | 14.99620 | 5.12063 | .71106 | |
| 34 | 16.39856 | 5.12063 | .63123 | |
| 35 | 17.80092 | 5.12063 | .56752 | |
| 36 | 19.20327 | 5.12063 | .51549 | |
| 37 | 20.60563 | 5.12063 | .47220 | |
| 38 | 22.00799 | 5.12063 | .43562 | |
| 39 | 23.41034 | 5.12063 | .40429 | |
| 40 | 24.81270 | 5.12063 | .37717 | |
| 41 | 14.78646 | 6.58965 | .93269 | .56952 |
| 42 | 15.94230 | 6.58965 | .84312 | .51946 |
| 43 | 17.09814 | 6.58965 | .76924 | .48885 |
| 44 | 18.25398 | 6.58965 | .70727 | |
| 45 | 19.40982 | 6.58965 | .65454 | |
| 46 | 20.56566 | 6.58965 | .60912 | |
| 47 | 21.72150 | 6.58965 | .56960 | |
| 48 | 22.87734 | 6.58965 | .53490 | |
| 49 | 24.03318 | 6.58965 | .50418 | |
| 50 | 25.18902 | 6.58965 | .47680 | |
| 51 | 17.13359 | 8.06080 | .93845 | .57074 |
| 52 | 18.08797 | 8.06080 | .87530 | .53970 |
| 53 | 19.04234 | 8.06080 | .82010 | .50741 |
| 54 | 19.99672 | 8.06080 | .77146 | .48948 |
| 55 | 20.95110 | 8.06080 | .72826 | |
| 56 | 21.90547 | 8.06080 | .68965 | |
| 57 | 22.85985 | 8.06080 | .65492 | |
| 58 | 23.81422 | 8.06080 | .62352 | |
| 59 | 24.76860 | 8.06080 | .59500 | |
| 60 | 25.72298 | 8.06080 | .56897 | |

| PANEL | X | Y | η | ΔCp |
|---|---|---|---|---|
| 61 | 19.32349 | 9.53094 | .95199 | .57448 |
| 62 | 20.11821 | 9.53094 | .90532 | .55885 |
| 63 | 20.91292 | 9.53094 | .86302 | .53171 |
| 64 | 21.70764 | 9.53094 | .82449 | .50970 |
| 65 | 22.50236 | 9.53094 | .78925 | .49520 |
| 66 | 23.29708 | 9.53094 | .75690 | .48533 |
| 67 | 24.09180 | 9.53094 | .72710 | |
| 68 | 24.88651 | 9.53094 | .69956 | |
| 69 | 25.68123 | 9.53094 | .67403 | |
| 70 | 26.47595 | 9.53094 | .65029 | |
| 71 | 21.46495 | 10.99792 | .96454 | .58116 |
| 72 | 22.12187 | 10.99792 | .92975 | .56890 |
| 73 | 22.77880 | 10.99792 | .89739 | .55388 |
| 74 | 23.43572 | 10.99792 | .86720 | .53443 |
| 75 | 24.09265 | 10.99792 | .83898 | .51729 |
| 76 | 24.74957 | 10.99792 | .81254 | .50403 |
| 77 | 25.40649 | 10.99792 | .78771 | .49462 |
| 78 | 26.06342 | 10.99792 | .76435 | .48746 |
| 79 | 26.72034 | 10.99792 | .74234 | |
| 80 | 27.37726 | 10.99792 | .72157 | |
| 81 | 23.59645 | 12.46176 | .97461 | .59445 |
| 82 | 24.12201 | 12.46176 | .94927 | .57304 |
| 83 | 24.64757 | 12.46176 | .92521 | .56722 |
| 84 | 25.17312 | 12.46176 | .90235 | .55706 |
| 85 | 25.69868 | 12.46176 | .88059 | .54311 |
| 86 | 26.22424 | 12.46176 | .85985 | .52965 |
| 87 | 26.74980 | 12.46176 | .84007 | .51786 |
| 88 | 27.27535 | 12.46176 | .82117 | .50797 |
| 89 | 27.80091 | 12.46176 | .80311 | .50046 |
| 90 | 28.32647 | 12.46176 | .78583 | .49391 |
| 91 | 26.04995 | 13.88143 | .96534 | .58158 |
| 92 | 26.40638 | 13.88143 | .95005 | .57345 |
| 93 | 26.76280 | 13.88143 | .93524 | .57006 |
| 94 | 27.11923 | 13.88143 | .92087 | .56540 |
| 95 | 27.47565 | 13.88143 | .90695 | .55954 |
| 96 | 27.83208 | 13.88143 | .89344 | .55135 |
| 97 | 28.18851 | 13.88143 | .88032 | .54294 |
| 98 | 28.54493 | 13.88143 | .86759 | .53468 |
| 99 | 28.90136 | 13.88143 | .85522 | .52664 |
| 100 | 29.25778 | 13.88143 | .84319 | .51950 |

## MIXED DESIGN – OPTIMAZATION RESULTS

WING DESIGNED FOR CL = .40000

CAMBER SLOPES AT PANEL CONTROL POINTS (95% of Panel)

| SPANWISE STATION | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CHORDWISE STATION | | | | | | | | | | |
| 1 | .05663 | .12507 | .15772 | -.11266 | -.00318 | .01929 | .02787 | .03718 | .04737 | .15638 |
| 2 | -.18038 | -.02475 | .00888 | -.12201 | -.03042 | -.01487 | -.00797 | .00255 | .01614 | .09926 |
| 3 | -.34828 | -.10448 | -.03153 | -.17095 | -.03522 | -.03068 | -.02682 | -.01796 | -.00384 | .06457 |
| 4 | -.40399 | -.13539 | -.07917 | -.20048 | -.06817 | -.03081 | -.03669 | -.03088 | -.01920 | .03998 |
| 5 | -.37131 | -.12809 | -.08731 | -.21317 | -.10640 | -.07114 | -.04247 | -.04209 | -.03234 | .02014 |
| 6 | -.32930 | -.12915 | -.10306 | -.21797 | -.13231 | -.09661 | -.04806 | -.05122 | -.04565 | .00368 |
| 7 | -.29035 | -.13045 | -.11329 | -.20705 | -.14348 | -.12079 | -.07920 | -.05427 | -.05637 | -.01025 |
| 8 | -.25976 | -.13324 | -.12286 | -.19405 | -.14510 | -.13398 | -.09664 | -.05935 | -.06476 | -.02200 |
| 9 | -.23002 | -.14508 | -.13408 | -.17799 | -.14616 | -.13863 | -.10984 | -.08247 | -.07282 | -.03602 |
| 10 | -.20364 | -.15657 | -.14717 | -.16484 | -.14649 | -.13729 | -.11813 | -.09474 | -.07723 | -.04800 |

WING CHORD LENGTHS(C)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 22.44247 | 19.59287 | 16.76196 | 14.02357 | 11.55840 | 9.54376 | 7.94718 | 6.56924 | 5.25557 | 3.56426 |

TANGENT OF THE LOCAL INCIDENCE ANGLE

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| .25604 | .09621 | .06519 | .17812 | .09569 | .07555 | .05379 | .03933 | .03087 | -.02677 |

CAMBER SLOPE (slopes have $\alpha$ removed, so that the camber line starts and ends at 0.0)

| SPANWISE STATION | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CHORDWISE STATION | | | | | | | | | | |
| 1 | .31267 | .22128 | .22290 | .06545 | .09251 | .09484 | .08167 | .07651 | .07824 | .12961 |
| 2 | .07565 | .07146 | .07406 | .05610 | .06527 | .06068 | .04583 | .04187 | .04701 | .07249 |
| 3 | -.09224 | -.00827 | .03366 | .00717 | .06048 | .04487 | .02698 | .02136 | .02703 | .03780 |
| 4 | -.14795 | -.03918 | -.01398 | -.02236 | .02752 | .04474 | .01710 | .00845 | .01167 | .01321 |
| 5 | -.11527 | -.03188 | -.02212 | -.03506 | -.01071 | .00441 | .01132 | -.00277 | -.00147 | -.00663 |
| 6 | -.07326 | -.03294 | -.03787 | -.03985 | -.03661 | -.02106 | .00574 | -.01189 | -.01478 | -.02309 |
| 7 | -.03431 | -.03424 | -.04810 | -.02893 | -.04779 | -.04524 | -.02541 | -.01495 | -.02550 | -.03703 |
| 8 | -.00372 | -.03702 | -.05767 | -.01594 | -.04940 | -.05843 | -.04284 | -.02003 | -.03389 | -.04877 |
| 9 | .02602 | -.04887 | -.06889 | .00012 | -.05047 | -.06308 | -.05605 | -.04315 | -.04195 | -.06280 |
| 10 | .05240 | -.06036 | -.08199 | .01328 | -.05080 | -.06174 | -.06434 | -.05541 | -.04636 | -.07478 |

CAMBER SHAPE

| SPANWISE STATION | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CHORDWISE STATION | | | | | | | | | | | |
| 1 | .03127 | .02213 | .02229 | .00655 | .00925 | .00948 | .00817 | .00765 | .00782 | .01296 | -95% |
| 2 | .03883 | .02927 | .02970 | .01216 | .01578 | .01555 | .01275 | .01184 | .01253 | .02021 | of panel |
| 3 | .02961 | .02845 | .03306 | .01287 | .02183 | .02004 | .01545 | .01397 | .01523 | .02399 | |
| 4 | .01481 | .02453 | .03166 | .01064 | .02458 | .02451 | .01716 | .01482 | .01640 | .02531 | |
| 5 | .00329 | .02134 | .02945 | .00713 | .02351 | .02495 | .01829 | .01454 | .01625 | .02465 | |

Note: 95% is taken to be equal to the T.E. location on the last panel

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | -.00404 | .01805 | .02566 | .00315 | .01985 | .02285 | .01886 | .01335 | .01477 | .02234 |
| 7 | -.00747 | .01463 | .02086 | .00025 | .01507 | .01832 | .01632 | .01186 | .01222 | .01863 |
| 8 | -.00784 | .01092 | .01509 | -.00134 | .01013 | .01248 | .01204 | .00986 | .00883 | .01376 |
| 9 | -.00524 | .00604 | .00820 | -.00133 | .00508 | .00617 | .00643 | .00554 | .00464 | .00748 |
| 10 | -.00000 | -.00000 | -.00000 | -.00000 | -.00000 | -.00000 | -.00000 | -.00000 | -.00000 | .00000 |

WING CAMBER SLOPES AT 75 PERCENT PANEL CHORD

| SPANWISE STATION | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CHORDWISE STATION | | | | | | | | | | |
| 1 | .10404 | .15504 | .18748 | -.11079 | .00226 | .02613 | .03504 | .04411 | .05362 | .16781 |
| 2 | -.13298 | .00522 | .03865 | -.12014 | -.02498 | -.00804 | -.00080 | .00947 | .02238 | .11068 |
| 3 | -.31470 | -.08854 | -.02345 | -.16116 | -.03426 | -.02752 | -.02305 | -.01386 | .00016 | .07151 |
| 4 | -.39285 | -.12921 | -.06964 | -.19457 | -.06158 | -.03079 | -.03472 | -.02830 | -.01612 | .04490 |
| 5 | -.37785 | -.12955 | -.08568 | -.21063 | -.09875 | -.06307 | -.04131 | -.03985 | -.02971 | .02411 |
| 6 | -.33770 | -.12894 | -.09991 | -.21701 | -.12713 | -.09151 | -.04694 | -.04939 | -.04299 | .00697 |
| 7 | -.29814 | -.13019 | -.11124 | -.20923 | -.14125 | -.11595 | -.07297 | -.05366 | -.05423 | -.00746 |
| 8 | -.26588 | -.13268 | -.12094 | -.19665 | -.14477 | -.13134 | -.09315 | -.05834 | -.06308 | -.01965 |
| 9 | -.23596 | -.14271 | -.13184 | -.18121 | -.14595 | -.13770 | -.10720 | -.07785 | -.07121 | -.03322 |
| 10 | -.20892 | -.15427 | -.14455 | -.16747 | -.14643 | -.13756 | -.11648 | -.09228 | -.07635 | -.04561 |

**NOTE: ONCE THE CAMBER SLOPES ARE DEFINED, THE PROGRAM BEGINS A STANDARD ANALYSIS. IF $\alpha \neq 0$, THEN $\alpha$ IS ADDED TO THE SLOPES FOR ANALYSIS.**

VFIX: FOR CARLSON CORRECTION IS BASED ON FLAT PLATE LINEAR THEORY AND IS 0 FOR DESIGN ($\alpha$ = 0).

WING UPPER SURFACE CONTROL POINTS, MACH=1.620 ALPHA= 0.000 VFIX= 0.00000

| | CONTROL POINTS | | | SOLUTION | | | | SLOPES AT CONTROL POINTS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| POINT | X | Y | Z | G | U | V | W | DZCDX (CAMBER) | DZTDX (THICKNESS) | CP | CPSTR (CARLSON CORRECTION) | POINT |
| 1 | 3.67416 | .71924 | -.12803 | .00000 | -.00416 | -.01955 | .12645 | .05663 | .05939 | .00833 | .02470 | 1 |
| 2 | 5.91841 | .71924 | -.12803 | .25386 | .11214 | -.26585 | -.10359 | -.18038 | .02645 | -.22428 | -.22681 | 2 |
| 3 | 8.16265 | .71924 | -.12803 | .34812 | .16490 | -.35451 | -.27769 | -.34828 | .01228 | -.32980 | -.26381 | 3 |
| 4 | 10.40690 | .71924 | -.12803 | .29355 | .14491 | -.31837 | -.35298 | -.40399 | .00057 | -.28982 | -.16779 | 4 |
| 5 | 12.65115 | .71924 | -.12803 | .17152 | .09650 | -.23428 | -.34697 | -.37131 | -.01093 | -.19301 | -.06088 | 5 |
| 6 | 14.89539 | .71924 | -.12803 | .10642 | .07278 | -.19717 | -.32275 | -.32930 | -.02204 | -.14555 | -.03207 | 6 |
| 7 | 17.13964 | .71924 | -.12803 | .08541 | .06973 | -.18380 | -.29698 | -.29035 | -.03274 | -.13946 | -.04857 | 7 |
| 8 | 19.38389 | .71924 | -.12803 | .07951 | .07091 | -.18267 | -.27711 | -.25976 | -.04305 | -.14182 | -.06728 | 8 |
| 9 | 21.62813 | .71924 | -.12803 | .07356 | .07366 | -.17593 | -.25864 | -.23002 | -.05292 | -.14733 | -.08512 | 9 |
| 10 | 23.87238 | .71924 | -.12803 | .07252 | .07804 | -.17617 | -.24198 | -.20364 | -.06246 | -.15607 | -.10402 | 10 |
| 11 | 6.54797 | 2.18669 | -.30771 | .00000 | .01955 | -.05431 | .18033 | .12507 | .05401 | -.03909 | -.00103 | 11 |
| 12 | 8.50726 | 2.18669 | -.30771 | .22952 | .11516 | -.24562 | .01369 | -.02475 | .02192 | -.23031 | -.24815 | 12 |
| 13 | 10.46655 | 2.18669 | -.30771 | .28722 | .14711 | -.28720 | -.07456 | -.10448 | .01092 | -.29423 | -.29884 | 13 |
| 14 | 12.42584 | 2.18669 | -.30771 | .26708 | .13658 | -.26867 | -.11718 | -.13539 | .00051 | -.27316 | -.27295 | 14 |
| 15 | 14.38512 | 2.18669 | -.30771 | .18776 | .11085 | -.22016 | -.12535 | -.12809 | -.01093 | -.22171 | -.21978 | 15 |
| 16 | 16.34441 | 2.18669 | -.30771 | .14724 | .09684 | -.20106 | -.13870 | -.12915 | -.02204 | -.19368 | -.18958 | 16 |
| 17 | 18.30370 | 2.18669 | -.30771 | .12688 | .09095 | -.19250 | -.15132 | -.13045 | -.03274 | -.18190 | -.17476 | 17 |
| 18 | 20.26299 | 2.18669 | -.30771 | .11887 | .09339 | -.19097 | -.16462 | -.13324 | -.04305 | -.18678 | -.17514 | 18 |
| 19 | 22.22227 | 2.18669 | -.30771 | .11940 | .09693 | -.19245 | -.18637 | -.14508 | -.05292 | -.19387 | -.17534 | 19 |
| 20 | 24.18156 | 2.18669 | -.30771 | .11804 | .10305 | -.19055 | -.20764 | -.15657 | -.06246 | -.20611 | -.17844 | 20 |
| 21 | 9.40619 | 3.65360 | -.35459 | .00000 | .03628 | -.08629 | .20671 | .15772 | .05019 | -.07256 | -.02647 | 21 |
| 22 | 11.08239 | 3.65360 | -.35459 | .24662 | .13306 | -.27300 | .02824 | .00888 | .01874 | -.26613 | -.28125 | 22 |
| 23 | 12.75859 | 3.65360 | -.35459 | .28962 | .15586 | -.29683 | -.02221 | -.03153 | .00995 | -.31171 | -.31867 | 23 |
| 24 | 14.43478 | 3.65360 | -.35459 | .29320 | .15580 | -.29454 | -.07934 | -.07917 | .00046 | -.31160 | -.31540 | 24 |
| 25 | 16.11098 | 3.65360 | -.35459 | .21040 | .12409 | -.24989 | -.09879 | -.08731 | -.01093 | -.24818 | -.25704 | 25 |
| 26 | 17.78717 | 3.65360 | -.35459 | .17731 | .11539 | -.23199 | -.12561 | -.10306 | -.02204 | -.23077 | -.23532 | 26 |
| 27 | 19.46337 | 3.65360 | -.35459 | .15177 | .10602 | -.22112 | -.14651 | -.11329 | -.03274 | -.21205 | -.21423 | 27 |
| 28 | 21.13957 | 3.65360 | -.35459 | .13940 | .10584 | -.21603 | -.16636 | -.12286 | -.04305 | -.21168 | -.20845 | 28 |
| 29 | 22.81576 | 3.65360 | -.35459 | .13656 | .10980 | -.21480 | -.18746 | -.13408 | -.05292 | -.21960 | -.20951 | 29 |
| 30 | 24.49196 | 3.65360 | -.35459 | .13300 | .11171 | -.21282 | -.21008 | -.14717 | -.06246 | -.22342 | -.20600 | 30 |
| 31 | 12.19149 | 5.12063 | -.33054 | .28719 | .19445 | -.39215 | -.07737 | -.11266 | .04794 | -.38890 | -.39101 | 31 |
| 32 | 13.59385 | 5.12063 | -.33054 | .25229 | .14145 | -.30223 | -.11428 | -.12201 | .01687 | -.28291 | -.29824 | 32 |
| 33 | 14.99620 | 5.12063 | -.33054 | .28876 | .15924 | -.31814 | -.17120 | -.17095 | .00938 | -.31849 | -.31944 | 33 |
| 34 | 16.39856 | 5.12063 | -.33054 | .28274 | .15540 | -.30848 | -.20988 | -.20048 | .00043 | -.31081 | -.30462 | 34 |
| 35 | 17.80092 | 5.12063 | -.33054 | .21354 | .12929 | -.27407 | -.23287 | -.21317 | -.01093 | -.25858 | -.25037 | 35 |
| 36 | 19.20327 | 5.12063 | -.33054 | .18034 | .11955 | -.25684 | -.24823 | -.21797 | -.02204 | -.23910 | -.22480 | 36 |
| 37 | 20.60563 | 5.12063 | -.33054 | .14936 | .10899 | -.24235 | -.24755 | -.20705 | -.03274 | -.21798 | -.20329 | 37 |
| 38 | 22.00799 | 5.12063 | -.33054 | .13090 | .10396 | -.23706 | -.24493 | -.19405 | -.04305 | -.20791 | -.19461 | 38 |
| 39 | 23.41034 | 5.12063 | -.33054 | .11764 | .10415 | -.23226 | -.23854 | -.17799 | -.05292 | -.20830 | -.19562 | 39 |
| 40 | 24.81270 | 5.12063 | -.33054 | .11538 | .10783 | -.23024 | -.23482 | -.16484 | -.06246 | -.21566 | -.20229 | 40 |
| 41 | 14.78646 | 6.58965 | -.29483 | .28476 | .20663 | -.37698 | .03780 | -.00318 | .04722 | -.41326 | -.39762 | 41 |
| 42 | 15.94230 | 6.58965 | -.29483 | .25973 | .15003 | -.28770 | -.01885 | -.03042 | .01630 | -.30006 | -.30869 | 42 |
| 43 | 17.09814 | 6.58965 | -.29483 | .24443 | .13968 | -.26595 | -.03076 | -.03522 | .00920 | -.27936 | -.28829 | 43 |
| 44 | 18.25398 | 6.58965 | -.29483 | .27922 | .15734 | -.28339 | -.07274 | -.06817 | .00042 | -.31469 | -.31490 | 44 |
| 45 | 19.40982 | 6.58965 | -.29483 | .25971 | .15720 | -.28130 | -.12202 | -.10640 | -.01094 | -.31439 | -.31010 | 45 |
| 46 | 20.56566 | 6.58965 | -.29483 | .23153 | .14700 | -.26959 | -.15884 | -.13231 | -.02204 | -.29400 | -.28829 | 46 |
| 47 | 21.72150 | 6.58965 | -.29483 | .20048 | .14013 | -.25611 | -.18049 | -.14348 | -.03274 | -.28025 | -.27081 | 47 |
| 48 | 22.87734 | 6.58965 | -.29483 | .17271 | .13047 | -.24513 | -.19224 | -.14510 | -.04305 | -.26095 | -.25109 | 48 |
| 49 | 24.03318 | 6.58965 | -.29483 | .15775 | .12674 | -.24113 | -.20311 | -.14616 | -.05292 | -.25348 | -.24187 | 49 |
| 50 | 25.18902 | 6.58965 | -.29483 | .14536 | .12629 | -.23762 | -.21292 | -.14649 | -.06246 | -.25257 | -.23773 | 50 |
| 51 | 17.13359 | 8.06080 | -.26778 | .28537 | .22470 | -.36678 | .05909 | .01929 | .04720 | -.44940 | -.41016 | 51 |
| 52 | 18.08797 | 8.06080 | -.26778 | .26985 | .16278 | -.27573 | -.00418 | -.01487 | .01628 | -.32556 | -.32098 | 52 |
| 53 | 19.04234 | 8.06080 | -.26778 | .25370 | .14716 | -.25212 | -.02652 | -.03068 | .00918 | -.29432 | -.29413 | 53 |
| 54 | 19.99672 | 8.06080 | -.26778 | .24474 | .14339 | -.23900 | -.03517 | -.03081 | .00042 | -.28678 | -.28519 | 54 |
| 55 | 20.95110 | 8.06080 | -.26778 | .27854 | .17134 | -.26842 | -.08744 | -.07114 | -.01094 | -.34269 | -.32701 | 55 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 21.90547 | 8.06080 | -.26778 | .27076 | .17260 | -.26857 | -.12413 | -.09661 | -.02204 | -.34520 | -.32566 | 56 |
| 57 | 22.85985 | 8.06080 | -.26778 | .25216 | .16824 | -.26335 | -.15890 | -.12079 | -.03274 | -.33649 | -.31465 | 57 |
| 58 | 23.81422 | 8.06080 | -.26778 | .21905 | .15862 | -.24885 | -.18212 | -.13398 | -.04305 | -.31725 | -.29424 | 58 |
| 59 | 24.76860 | 8.06080 | -.26778 | .19114 | .14893 | -.23894 | -.19644 | -.13863 | -.05292 | -.29787 | -.27534 | 59 |
| 60 | 25.72298 | 8.06080 | -.26778 | .16992 | .14201 | -.23334 | -.20453 | -.13729 | -.06246 | -.28402 | -.26215 | 60 |
| 61 | 19.32349 | 9.53094 | -.23740 | .28724 | .24097 | -.37345 | .06725 | .02787 | .04720 | -.48194 | -.42551 | 61 |
| 62 | 20.11821 | 9.53094 | -.23740 | .27943 | .17457 | -.27885 | .00246 | -.00797 | .01628 | -.34914 | -.33601 | 62 |
| 63 | 20.91292 | 9.53094 | -.23740 | .26586 | .15601 | -.25606 | -.02301 | -.02682 | .00918 | -.31201 | -.30679 | 63 |
| 64 | 21.70764 | 9.53094 | -.23740 | .25485 | .15469 | -.24527 | -.04143 | -.03669 | .00042 | -.30939 | -.30174 | 64 |
| 65 | 22.50236 | 9.53094 | -.23740 | .24760 | .16007 | -.24786 | -.05861 | -.04247 | -.01094 | -.32015 | -.30880 | 65 |
| 66 | 23.29708 | 9.53094 | -.23740 | .24267 | .16402 | -.25089 | -.07537 | -.04806 | -.02204 | -.32803 | -.31383 | 66 |
| 67 | 24.09180 | 9.53094 | -.23740 | .27582 | .18296 | -.26752 | -.11760 | -.07920 | -.03274 | -.36592 | -.33858 | 67 |
| 68 | 24.88651 | 9.53094 | -.23740 | .26415 | .18369 | -.26880 | -.14537 | -.09664 | -.04305 | -.36737 | -.33708 | 68 |
| 69 | 25.68123 | 9.53094 | -.23740 | .24085 | .17891 | -.25771 | -.16823 | -.10984 | -.05292 | -.35781 | -.32536 | 69 |
| 70 | 26.47595 | 9.53094 | -.23740 | .21174 | .16879 | -.24639 | -.18582 | -.11813 | -.06246 | -.33758 | -.30662 | 70 |
| 71 | 21.46495 | 10.99792 | -.21929 | .29058 | .25237 | -.38431 | .08269 | .03718 | .04720 | -.50473 | -.43719 | 71 |
| 72 | 22.12187 | 10.99792 | -.21929 | .28445 | .18297 | -.28797 | .01772 | .00255 | .01628 | -.36593 | -.34815 | 72 |
| 73 | 22.77880 | 10.99792 | -.21929 | .27694 | .16503 | -.26758 | -.00977 | -.01796 | .00918 | -.33007 | -.32138 | 73 |
| 74 | 23.43572 | 10.99792 | -.21929 | .26722 | .16536 | -.26452 | -.03191 | -.03088 | .00042 | -.33072 | -.32061 | 74 |
| 75 | 24.09265 | 10.99792 | -.21929 | .25865 | .16972 | -.26131 | -.05441 | -.04209 | -.01094 | -.33944 | -.32433 | 75 |
| 76 | 24.74957 | 10.99792 | -.21929 | .25202 | .17407 | -.26363 | -.07473 | -.05122 | -.02204 | -.34814 | -.32925 | 76 |
| 77 | 25.40649 | 10.99792 | -.21929 | .24731 | .17737 | -.26610 | -.08857 | -.05427 | -.03274 | -.35475 | -.33304 | 77 |
| 78 | 26.06342 | 10.99792 | -.21929 | .24373 | .17883 | -.26660 | -.10322 | -.05935 | -.04305 | -.35766 | -.33369 | 78 |
| 79 | 26.72034 | 10.99792 | -.21929 | .26874 | .19663 | -.28184 | -.13626 | -.08247 | -.05292 | -.39327 | -.35548 | 79 |
| 80 | 27.37726 | 10.99792 | -.21929 | .25832 | .19878 | -.27645 | -.15805 | -.09474 | -.06246 | -.39756 | -.35406 | 80 |
| 81 | 23.59645 | 12.46176 | -.22337 | .29723 | .26526 | -.39917 | .09779 | .04737 | .04720 | -.53052 | -.45014 | 81 |
| 82 | 24.12201 | 12.46176 | -.22337 | .28652 | .18992 | -.29623 | .03490 | .01614 | .01628 | -.37984 | -.35793 | 82 |
| 83 | 24.64757 | 12.46176 | -.22337 | .28361 | .17285 | -.27776 | .00770 | -.00384 | .00918 | -.34570 | -.33374 | 83 |
| 84 | 25.17312 | 12.46176 | -.22337 | .27853 | .17305 | -.28220 | -.01644 | -.01920 | .00042 | -.34610 | -.33506 | 84 |
| 85 | 25.69868 | 12.46176 | -.22337 | .27156 | .18132 | -.27262 | -.04122 | -.03234 | -.01094 | -.36264 | -.34150 | 85 |
| 86 | 26.22424 | 12.46176 | -.22337 | .26483 | .19055 | -.27392 | -.06563 | -.04565 | -.02204 | -.38109 | -.35141 | 86 |
| 87 | 26.74980 | 12.46176 | -.22337 | .25893 | .19468 | -.27443 | -.08708 | -.05637 | -.03274 | -.38935 | -.35494 | 87 |
| 88 | 27.27535 | 12.46176 | -.22337 | .25398 | .19757 | -.27558 | -.10582 | -.06476 | -.04305 | -.39514 | -.35710 | 88 |
| 89 | 27.80091 | 12.46176 | -.22337 | .25023 | .19675 | -.27304 | -.12326 | -.07282 | -.05292 | -.39351 | -.35387 | 89 |
| 90 | 28.32647 | 12.46176 | -.22337 | .24695 | .20148 | -.27840 | -.13717 | -.07723 | -.06246 | -.40297 | -.35917 | 90 |
| 91 | 26.04995 | 13.88143 | -.19751 | .29079 | .23525 | -.47981 | .18111 | .15638 | .04720 | -.47050 | -.43678 | 91 |
| 92 | 26.40638 | 13.88143 | -.19751 | .28673 | .19333 | -.40657 | .09633 | .09926 | .01628 | -.38666 | -.38746 | 92 |
| 93 | 26.76280 | 13.88143 | -.19751 | .28503 | .18710 | -.40038 | .05504 | .06457 | .00918 | -.37421 | -.38358 | 93 |
| 94 | 27.11923 | 13.88143 | -.19751 | .28270 | .18867 | -.40732 | .02161 | .03998 | .00042 | -.37734 | -.38981 | 94 |
| 95 | 27.47565 | 13.88143 | -.19751 | .27977 | .18899 | -.41259 | -.00946 | .02014 | -.01094 | -.37797 | -.39310 | 95 |
| 96 | 27.83208 | 13.88143 | -.19751 | .27568 | .19400 | -.42344 | -.03720 | .00368 | -.02204 | -.38801 | -.40170 | 96 |
| 97 | 28.18851 | 13.88143 | -.19751 | .27147 | .19593 | -.43044 | -.06184 | -.01025 | -.03274 | -.39187 | -.40567 | 97 |
| 98 | 28.54493 | 13.88143 | -.19751 | .26734 | .19957 | -.43392 | -.08374 | -.02200 | -.04305 | -.39914 | -.40970 | 98 |
| 99 | 28.90136 | 13.88143 | -.19751 | .26332 | .20859 | -.42733 | -.10700 | -.03602 | -.05292 | -.41719 | -.41485 | 99 |
| 100 | 29.25778 | 13.88143 | -.19751 | .25975 | .21108 | -.42863 | -.13211 | -.04800 | -.06246 | -.42216 | -.41689 | 100 |

SC3 DEMO WING ALONE FOR COMBINED ANALYSIS DESIGN-CRAIDON GEOMETRY
AERO SECTION - DEMO WING - BASIC L.E.

SPANWISE PRESSURE DISTRIBUTION

ON THE WING UPPER SURFACE

JSTN= 1 X(JST)= 15.50000

| JQ | Y | ETA | BASIC CP | CARLSON CORRECTION CPSTR |
|---|---|---|---|---|
| 1 | .71924 | .09554 | -.14391 | -.03651 |
| 2 | 2.18669 | .29045 | -.20576 | -.20259 |
| 3 | 3.65360 | .48530 | -.27129 | -.27831 |
| 4 | 5.12063 | .68016 | -.31573 | -.31412 |
| 5 | 6.58965 | .87528 | -.34338 | -.34272 |

JSTN= 2 X(JST)= 19.90000

| JQ | Y | ETA | CP | CPSTR |
|---|---|---|---|---|
| 1 | .71924 | .06925 | -.14309 | -.07138 |
| 2 | 2.18669 | .21054 | -.18587 | -.17507 |
| 3 | 3.65360 | .35178 | -.21195 | -.21273 |
| 4 | 5.12063 | .49303 | -.22861 | -.21411 |
| 5 | 6.58965 | .63448 | -.30574 | -.30085 |
| 6 | 8.06080 | .77612 | -.28755 | -.28610 |
| 7 | 9.53094 | .91767 | -.38560 | -.36058 |

JSTN= 3 X(JST)= 24.40000

| JQ | Y | ETA | CP | CPSTR |
|---|---|---|---|---|
| 1 | 3.65360 | .27454 | -.22321 | -.20619 |
| 2 | 5.12063 | .38477 | -.21349 | -.20033 |
| 3 | 6.58965 | .49515 | -.25319 | -.24056 |
| 4 | 8.06080 | .60570 | -.30535 | -.28264 |
| 5 | 9.53094 | .71616 | -.36649 | -.33800 |
| 6 | 10.99792 | .82640 | -.34351 | -.32663 |
| 7 | 12.46176 | .93639 | -.36178 | -.34513 |

**INTERPOLATION OF RESULTS FROM CONTROL POINTS TO SPECIFIED X STATION TO PROVIDE SPANWISE PRESSURE DISTRIBUTIONS**

SC3 DEMO WING ALONE FOR COMBINED ANALYSIS DESIGN-CRAIDON GEOMETRY
AERO SECTION - DEMO WING - BASIC L.E.

INTEGRATION OF THE PRESSURE DISTRIBUTION

ON THE WING UPPER SURFACE

INTERPOLATION OF PRESSURES
TO PANEL MIDPOINT

MACH= 1.6200 ALPHA= 0.0000

| POINT | X | Y | Z | X/C | 2Y/B | Z/C | CP | CPSTR | POINT |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.66425 | .71924 | -.12803 | .05000 | .04894 | 0.00000 | .00833 | .02470 | 1 |
| 2 | 4.90849 | .71924 | -.12803 | .15000 | .04894 | 0.00000 | -.22428 | -.22681 | 2 |
| 3 | 7.15274 | .71924 | -.12803 | .25000 | .04894 | 0.00000 | -.32980 | -.26381 | 3 |
| 4 | 9.39699 | .71924 | -.12803 | .35000 | .04894 | 0.00000 | -.28982 | -.16779 | 4 |
| 5 | 11.64123 | .71924 | -.12803 | .45000 | .04894 | 0.00000 | -.19301 | -.06088 | 5 |
| 6 | 13.88548 | .71924 | -.12803 | .55000 | .04894 | 0.00000 | -.14555 | -.03207 | 6 |
| 7 | 16.12973 | .71924 | -.12803 | .65000 | .04894 | .00000 | -.13946 | -.04857 | 7 |
| 8 | 18.37397 | .71924 | -.12803 | .75000 | .04894 | 0.00000 | -.14182 | -.06728 | 8 |
| 9 | 20.61822 | .71924 | -.12803 | .85000 | .04894 | 0.00000 | -.14733 | -.08512 | 9 |
| 10 | 22.86247 | .71924 | -.12803 | .95000 | .04894 | 0.00000 | -.15607 | -.10402 | 10 |
| 11 | 5.66629 | 2.18669 | -.30771 | .05000 | .14878 | 0.00000 | -.03909 | -.00103 | 11 |
| 12 | 7.62558 | 2.18669 | -.30771 | .15000 | .14878 | -.00000 | -.23031 | -.24815 | 12 |
| 13 | 9.58487 | 2.18669 | -.30771 | .25000 | .14878 | 0.00000 | -.29423 | -.29884 | 13 |
| 14 | 11.54416 | 2.18669 | -.30771 | .35000 | .14878 | -.00000 | -.27316 | -.27295 | 14 |
| 15 | 13.50344 | 2.18669 | -.30771 | .45000 | .14878 | 0.00000 | -.22171 | -.21978 | 15 |
| 16 | 15.46273 | 2.18669 | -.30771 | .55000 | .14878 | -.00000 | -.19368 | -.18958 | 16 |
| 17 | 17.42202 | 2.18669 | -.30771 | .65000 | .14878 | 0.00000 | -.18190 | -.17476 | 17 |
| 18 | 19.38131 | 2.18669 | -.30771 | .75000 | .14878 | -.00000 | -.18678 | -.17514 | 18 |
| 19 | 21.34059 | 2.18669 | -.30771 | .85000 | .14878 | 0.00000 | -.19387 | -.17534 | 19 |
| 20 | 23.29988 | 2.18669 | -.30771 | .95000 | .14878 | -.00000 | -.20611 | -.17844 | 20 |
| 21 | 8.65191 | 3.65360 | -.35459 | .05000 | .24859 | 0.00000 | -.07256 | -.02647 | 21 |
| 22 | 10.32810 | 3.65360 | -.35459 | .15000 | .24859 | 0.00000 | -.26613 | -.28125 | 22 |
| 23 | 12.00430 | 3.65360 | -.35459 | .25000 | .24859 | 0.00000 | -.31171 | -.31867 | 23 |
| 24 | 13.68049 | 3.65360 | -.35459 | .35000 | .24859 | 0.00000 | -.31160 | -.31540 | 24 |
| 25 | 15.35669 | 3.65360 | -.35459 | .45000 | .24859 | 0.00000 | -.24818 | -.25704 | 25 |
| 26 | 17.03289 | 3.65360 | -.35459 | .55000 | .24859 | 0.00000 | -.23077 | -.23532 | 26 |
| 27 | 18.70908 | 3.65360 | -.35459 | .65000 | .24859 | 0.00000 | -.21205 | -.21423 | 27 |
| 28 | 20.38528 | 3.65360 | -.35459 | .75000 | .24859 | 0.00000 | -.21168 | -.20845 | 28 |
| 29 | 22.06147 | 3.65360 | -.35459 | .85000 | .24859 | -.00000 | -.21960 | -.20951 | 29 |
| 30 | 23.73767 | 3.65360 | -.35459 | .95000 | .24859 | 0.00000 | -.22342 | -.20600 | 30 |
| 31 | 11.56043 | 5.12063 | -.33054 | .05000 | .34841 | 0.00000 | -.38890 | -.39101 | 31 |
| 32 | 12.96279 | 5.12063 | -.33054 | .15000 | .34841 | 0.00000 | -.28291 | -.29824 | 32 |
| 33 | 14.36514 | 5.12063 | -.33054 | .25000 | .34841 | 0.00000 | -.31849 | -.31944 | 33 |
| 34 | 15.76750 | 5.12063 | -.33054 | .35000 | .34841 | .00000 | -.31081 | -.30462 | 34 |
| 35 | 17.16986 | 5.12063 | -.33054 | .45000 | .34841 | 0.00000 | -.25858 | -.25037 | 35 |
| 36 | 18.57221 | 5.12063 | -.33054 | .55000 | .34841 | 0.00000 | -.23910 | -.22480 | 36 |
| 37 | 19.97457 | 5.12063 | -.33054 | .65000 | .34841 | 0.00000 | -.21798 | -.20329 | 37 |
| 38 | 21.37693 | 5.12063 | -.33054 | .75000 | .34841 | 0.00000 | -.20791 | -.19461 | 38 |
| 39 | 22.77928 | 5.12063 | -.33054 | .85000 | .34841 | 0.00000 | -.20830 | -.19562 | 39 |
| 40 | 24.18164 | 5.12063 | -.33054 | .95000 | .34841 | 0.00000 | -.21566 | -.20229 | 40 |
| 41 | 14.26633 | 6.58965 | -.29483 | .05000 | .44837 | 0.00000 | -.41326 | -.39762 | 41 |
| 42 | 15.42217 | 6.58965 | -.29483 | .15000 | .44837 | 0.00000 | -.30006 | -.30869 | 42 |
| 43 | 16.57801 | 6.58965 | -.29483 | .25000 | .44837 | 0.00000 | -.27936 | -.28829 | 43 |
| 44 | 17.73385 | 6.58965 | -.29483 | .35000 | .44837 | 0.00000 | -.31469 | -.31490 | 44 |
| 45 | 18.88969 | 6.58965 | -.29483 | .45000 | .44837 | 0.00000 | -.31439 | -.31010 | 45 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 46 | 20.04553 | 6.58965 | -.29483 | .55000 | .44837 | 0.00000 | -.29400 | -.28829 | 46 |
| 47 | 21.20137 | 6.58965 | -.29483 | .65000 | .44837 | 0.00000 | -.28025 | -.27081 | 47 |
| 48 | 22.35721 | 6.58965 | -.29483 | .75000 | .44837 | 0.00000 | -.26095 | -.25109 | 48 |
| 49 | 23.51305 | 6.58965 | -.29483 | .85000 | .44837 | 0.00000 | -.25348 | -.24187 | 49 |
| 50 | 24.66889 | 6.58965 | -.29483 | .95000 | .44837 | 0.00000 | -.25257 | -.23773 | 50 |
| 51 | 16.70412 | 8.06080 | -.26778 | .05000 | .54847 | 0.00000 | -.44940 | -.41016 | 51 |
| 52 | 17.65850 | 8.06080 | -.26778 | .15000 | .54847 | 0.00000 | -.32556 | -.32098 | 52 |
| 53 | 18.61287 | 8.06080 | -.26778 | .25000 | .54847 | 0.00000 | -.29432 | -.29413 | 53 |
| 54 | 19.56725 | 8.06080 | -.26778 | .35000 | .54847 | 0.00000 | -.28678 | -.28519 | 54 |
| 55 | 20.52163 | 8.06080 | -.26778 | .45000 | .54847 | 0.00000 | -.34269 | -.32701 | 55 |
| 56 | 21.47600 | 8.06080 | -.26778 | .55000 | .54847 | 0.00000 | -.34520 | -.32566 | 56 |
| 57 | 22.43038 | 8.06080 | -.26778 | .65000 | .54847 | 0.00000 | -.33649 | -.31465 | 57 |
| 58 | 23.38475 | 8.06080 | -.26778 | .75000 | .54847 | 0.00000 | -.31725 | -.29424 | 58 |
| 59 | 24.33913 | 8.06080 | -.26778 | .85000 | .54847 | 0.00000 | -.29787 | -.27534 | 59 |
| 60 | 25.29351 | 8.06080 | -.26778 | .95000 | .54847 | 0.00000 | -.28402 | -.26215 | 60 |
| 61 | 18.96586 | 9.53094 | -.23740 | .05000 | .64850 | 0.00000 | -.48194 | -.42551 | 61 |
| 62 | 19.76058 | 9.53094 | -.23740 | .15000 | .64850 | -.00000 | -.34914 | -.33601 | 62 |
| 63 | 20.55530 | 9.53094 | -.23740 | .25000 | .64850 | -.00000 | -.31201 | -.30679 | 63 |
| 64 | 21.35002 | 9.53094 | -.23740 | .35000 | .64850 | .00000 | -.30939 | -.30174 | 64 |
| 65 | 22.14474 | 9.53094 | -.23740 | .45000 | .64850 | -.00000 | -.32015 | -.30880 | 65 |
| 66 | 22.93945 | 9.53094 | -.23740 | .55000 | .64850 | -.00000 | -.32803 | -.31383 | 66 |
| 67 | 23.73417 | 9.53094 | -.23740 | .65000 | .64850 | -.00000 | -.36592 | -.33858 | 67 |
| 68 | 24.52889 | 9.53094 | -.23740 | .75000 | .64850 | 0.00000 | -.36737 | -.33708 | 68 |
| 69 | 25.32361 | 9.53094 | -.23740 | .85000 | .64850 | -.00000 | -.35781 | -.32536 | 69 |
| 70 | 26.11833 | 9.53094 | -.23740 | .95000 | .64850 | -.00000 | -.33758 | -.30662 | 70 |
| 71 | 21.16934 | 10.99792 | -.21929 | .05000 | .74831 | 0.00000 | -.50473 | -.43719 | 71 |
| 72 | 21.82626 | 10.99792 | -.21929 | .15000 | .74831 | 0.00000 | -.36593 | -.34815 | 72 |
| 73 | 22.48318 | 10.99792 | -.21929 | .25000 | .74831 | 0.00000 | -.33007 | -.32138 | 73 |
| 74 | 23.14011 | 10.99792 | -.21929 | .35000 | .74831 | 0.00000 | -.33072 | -.32061 | 74 |
| 75 | 23.79703 | 10.99792 | -.21929 | .45000 | .74831 | 0.00000 | -.33944 | -.32433 | 75 |
| 76 | 24.45395 | 10.99792 | -.21929 | .55000 | .74831 | 0.00000 | -.34814 | -.32925 | 76 |
| 77 | 25.11088 | 10.99792 | -.21929 | .65000 | .74831 | 0.00000 | -.35475 | -.33304 | 77 |
| 78 | 25.76780 | 10.99792 | -.21929 | .75000 | .74831 | 0.00000 | -.35766 | -.33369 | 78 |
| 79 | 26.42473 | 10.99792 | -.21929 | .85000 | .74831 | 0.00000 | -.39327 | -.35548 | 79 |
| 80 | 27.08165 | 10.99792 | -.21929 | .95000 | .74831 | 0.00000 | -.39756 | -.35406 | 80 |
| 81 | 23.35995 | 12.46176 | -.22337 | .05000 | .84791 | 0.00000 | -.53052 | -.45014 | 81 |
| 82 | 23.88551 | 12.46176 | -.22337 | .15000 | .84791 | 0.00000 | -.37984 | -.35793 | 82 |
| 83 | 24.41107 | 12.46176 | -.22337 | .25000 | .84791 | 0.00000 | -.34570 | -.33374 | 83 |
| 84 | 24.93662 | 12.46176 | -.22337 | .35000 | .84791 | 0.00000 | -.34610 | -.33506 | 84 |
| 85 | 25.46218 | 12.46176 | -.22337 | .45000 | .84791 | 0.00000 | -.36264 | -.34150 | 85 |
| 86 | 25.98774 | 12.46176 | -.22337 | .55000 | .84791 | 0.00000 | -.38109 | -.35141 | 86 |
| 87 | 26.51330 | 12.46176 | -.22337 | .65000 | .84791 | 0.00000 | -.38935 | -.35494 | 87 |
| 88 | 27.03885 | 12.46176 | -.22337 | .75000 | .84791 | 0.00000 | -.39514 | -.35710 | 88 |
| 89 | 27.56441 | 12.46176 | -.22337 | .85000 | .84791 | 0.00000 | -.39351 | -.35387 | 89 |
| 90 | 28.08997 | 12.46176 | -.22337 | .95000 | .84791 | 0.00000 | -.40297 | -.35917 | 90 |
| 91 | 25.88956 | 13.88143 | -.19751 | .05000 | .94451 | 0.00000 | -.47050 | -.43678 | 91 |
| 92 | 26.24598 | 13.88143 | -.19751 | .15000 | .94451 | .00000 | -.38666 | -.38746 | 92 |
| 93 | 26.60241 | 13.88143 | -.19751 | .25000 | .94451 | .00000 | -.37421 | -.38358 | 93 |
| 94 | 26.95884 | 13.88143 | -.19751 | .35000 | .94451 | .00000 | -.37734 | -.38981 | 94 |
| 95 | 27.31526 | 13.88143 | -.19751 | .45000 | .94451 | .00000 | -.37797 | -.39310 | 95 |
| 96 | 27.67169 | 13.88143 | -.19751 | .55000 | .94451 | .00000 | -.38801 | -.40170 | 96 |
| 97 | 28.02811 | 13.88143 | -.19751 | .65000 | .94451 | 0.00000 | -.39187 | -.40567 | 97 |
| 98 | 28.38454 | 13.88143 | -.19751 | .75000 | .94451 | .00000 | -.39914 | -.40970 | 98 |
| 99 | 28.74097 | 13.88143 | -.19751 | .85000 | .94451 | .00000 | -.41719 | -.41485 | 99 |
| 100 | 29.09739 | 13.88143 | -.19751 | .95000 | .94451 | .00000 | -.42216 | -.41689 | 100 |

WING LOWER SURFACE CONTROL POINTS, MACH=1.620   ALPHA=  0.000   VFIX=     0.00000

| POINT | X | Y | Z | G | U | V | W | DZCDX | DZTDX | CP | CPSTR | POINT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.67416 | .71924 | -.12803 | .00000 | -.00416 | -.04037 | .00951 | .05663 | .05939 | .00833 | .00661 | 1 |
| 2 | 5.91841 | .71924 | -.12803 | .25386 | -.14172 | .20465 | -.24107 | -.18038 | .02645 | .28344 | .29529 | 2 |
| 3 | 8.16265 | .71924 | -.12803 | .34812 | -.18322 | .28134 | -.41583 | -.34828 | .01228 | .36645 | .42450 | 3 |
| 4 | 10.40690 | .71924 | -.12803 | .29355 | -.14864 | .23901 | -.45336 | -.40399 | .00057 | .29728 | .41696 | 4 |
| 5 | 12.65115 | .71924 | -.12803 | .17152 | -.07502 | .16547 | -.39592 | -.37131 | -.01093 | .15003 | .25517 | 5 |
| 6 | 14.89539 | .71924 | -.12803 | .10642 | -.03365 | .13249 | -.33665 | -.32930 | -.02204 | .06729 | .14053 | 6 |
| 7 | 17.13964 | .71924 | -.12803 | .08541 | -.01568 | .12968 | -.28628 | -.29035 | -.03274 | .03136 | .07490 | 7 |
| 8 | 19.38389 | .71924 | -.12803 | .07951 | -.00860 | .12994 | -.24531 | -.25976 | -.04305 | .01721 | .04113 | 8 |
| 9 | 21.62813 | .71924 | -.12803 | .07356 | .00011 | .13675 | -.20679 | -.23002 | -.05292 | -.00021 | .00585 | 9 |
| 10 | 23.87238 | .71924 | -.12803 | .07252 | .00552 | .13945 | -.17128 | -.20364 | -.06246 | -.01104 | -.01651 | 10 |
| 11 | 6.54797 | 2.18669 | -.30771 | .00000 | .01955 | -.06124 | .07253 | .12507 | .05401 | -.03909 | -.03706 | 11 |
| 12 | 8.50726 | 2.18669 | -.30771 | .22952 | -.11437 | .19673 | -.05868 | -.02475 | .02192 | .22873 | .18721 | 12 |
| 13 | 10.46655 | 2.18669 | -.30771 | .28722 | -.14010 | .25731 | -.13144 | -.10448 | .01092 | .28021 | .22026 | 13 |
| 14 | 12.42584 | 2.18669 | -.30771 | .26708 | -.13050 | .24590 | -.15128 | -.13539 | .00051 | .26101 | .21708 | 14 |
| 15 | 14.38512 | 2.18669 | -.30771 | .18776 | -.07691 | .18803 | -.12968 | -.12809 | -.01093 | .15381 | .13374 | 15 |
| 16 | 16.34441 | 2.18669 | -.30771 | .14724 | -.05040 | .16129 | -.11781 | -.12915 | -.02204 | .10080 | .08782 | 16 |
| 17 | 18.30370 | 2.18669 | -.30771 | .12688 | -.03594 | .15141 | -.10781 | -.13045 | -.03274 | .07187 | .05932 | 17 |
| 18 | 20.26299 | 2.18669 | -.30771 | .11887 | -.02548 | .14800 | -.10014 | -.13324 | -.04305 | .05096 | .03741 | 18 |
| 19 | 22.22227 | 2.18669 | -.30771 | .11940 | -.02246 | .14810 | -.10219 | -.14508 | -.05292 | .04493 | .03148 | 19 |
| 20 | 24.18156 | 2.18669 | -.30771 | .11804 | -.01499 | .15069 | -.10440 | -.15657 | -.06246 | .02998 | .01583 | 20 |
| 21 | 9.40619 | 3.65360 | -.35459 | .00000 | .03628 | -.08608 | .10634 | .15772 | .05019 | -.07256 | -.06578 | 21 |
| 22 | 11.08239 | 3.65360 | -.35459 | .24662 | -.11356 | .20297 | -.00824 | .00888 | .01874 | .22712 | .18001 | 22 |
| 23 | 12.75859 | 3.65360 | -.35459 | .28962 | -.13376 | .25382 | -.04094 | -.03153 | .00995 | .26752 | .19336 | 23 |
| 24 | 14.43478 | 3.65360 | -.35459 | .29320 | -.13740 | .26161 | -.07907 | -.07917 | .00046 | .27481 | .20417 | 24 |
| 25 | 16.11098 | 3.65360 | -.35459 | .21040 | -.08631 | .19410 | -.07598 | -.08731 | -.01093 | .17262 | .14089 | 25 |
| 26 | 17.78717 | 3.65360 | -.35459 | .17731 | -.06192 | .17350 | -.08066 | -.10306 | -.02204 | .12385 | .10189 | 26 |
| 27 | 19.46337 | 3.65360 | -.35459 | .15177 | -.04574 | .15953 | -.08022 | -.11329 | -.03274 | .09149 | .07429 | 27 |
| 28 | 21.13957 | 3.65360 | -.35459 | .13940 | -.03356 | .15495 | -.07947 | -.12286 | -.04305 | .06712 | .05104 | 28 |
| 29 | 22.81576 | 3.65360 | -.35459 | .13656 | -.02676 | .15447 | -.08083 | -.13408 | -.05292 | .05351 | .03766 | 29 |
| 30 | 24.49196 | 3.65360 | -.35459 | .13300 | -.02129 | .15501 | -.08438 | -.14717 | -.06246 | .04259 | .02710 | 30 |
| 31 | 12.19149 | 5.12063 | -.33054 | .28719 | -.09274 | .19257 | -.15486 | -.11266 | .04794 | .18548 | .19160 | 31 |
| 32 | 13.59385 | 5.12063 | -.33054 | .25229 | -.11084 | .21616 | -.13168 | -.12201 | .01687 | .22167 | .20528 | 32 |
| 33 | 14.99620 | 5.12063 | -.33054 | .28876 | -.12951 | .26044 | -.17171 | -.17095 | .00938 | .25903 | .23965 | 33 |
| 34 | 16.39856 | 5.12063 | -.33054 | .28274 | -.12733 | .26061 | -.19279 | -.20048 | .00043 | .25467 | .24738 | 34 |
| 35 | 17.80092 | 5.12063 | -.33054 | .21354 | -.08425 | .20423 | -.19590 | -.21317 | -.01093 | .16849 | .18864 | 35 |
| 36 | 19.20327 | 5.12063 | -.33054 | .18034 | -.06079 | .18355 | -.19023 | -.21797 | -.02204 | .12157 | .14309 | 36 |
| 37 | 20.60563 | 5.12063 | -.33054 | .14936 | -.04037 | .16826 | -.16909 | -.20705 | -.03274 | .08074 | .09422 | 37 |
| 38 | 22.00799 | 5.12063 | -.33054 | .13090 | -.02694 | .15889 | -.14629 | -.19405 | -.04305 | .05388 | .05903 | 38 |
| 39 | 23.41034 | 5.12063 | -.33054 | .11764 | -.01348 | .15540 | -.12040 | -.17799 | -.05292 | .02697 | .02320 | 39 |
| 40 | 24.81270 | 5.12063 | -.33054 | .11538 | -.00755 | .15593 | -.09765 | -.16484 | -.06246 | .01510 | .00439 | 40 |
| 41 | 14.78646 | 6.58965 | -.29483 | .28476 | -.07813 | .14199 | -.04805 | -.00318 | .04722 | .15626 | .13987 | 41 |
| 42 | 15.94230 | 6.58965 | -.29483 | .25973 | -.10970 | .18861 | -.04355 | -.03042 | .01630 | .21940 | .18382 | 42 |
| 43 | 17.09814 | 6.58965 | -.29483 | .24443 | -.10475 | .18702 | -.04165 | -.03522 | .00920 | .20949 | .17425 | 43 |
| 44 | 18.25398 | 6.58965 | -.29483 | .27922 | -.12187 | .21647 | -.06529 | -.06817 | .00042 | .24374 | .19869 | 44 |
| 45 | 19.40982 | 6.58965 | -.29483 | .25971 | -.10252 | .19473 | -.09225 | -.10640 | -.01094 | .20504 | .17937 | 45 |
| 46 | 20.56566 | 6.58965 | -.29483 | .23153 | -.08453 | .17651 | -.10735 | -.13231 | -.02204 | .16907 | .15597 | 46 |
| 47 | 21.72150 | 6.58965 | -.29483 | .20048 | -.06036 | .16182 | -.10808 | -.14348 | -.03274 | .12072 | .11213 | 47 |
| 48 | 22.87734 | 6.58965 | -.29483 | .17271 | -.04224 | .15184 | -.09954 | -.14510 | -.04305 | .08447 | .07564 | 48 |
| 49 | 24.03318 | 6.58965 | -.29483 | .15775 | -.03101 | .14672 | -.09082 | -.14616 | -.05292 | .06202 | .05188 | 49 |
| 50 | 25.18902 | 6.58965 | -.29483 | .14536 | -.01907 | .14452 | -.08165 | -.14649 | -.06246 | .03815 | .02615 | 50 |
| 51 | 17.13359 | 8.06080 | -.26778 | .28537 | -.06067 | .09941 | -.02586 | .01929 | .04720 | .12135 | .11320 | 51 |
| 52 | 18.08797 | 8.06080 | -.26778 | .26985 | -.10707 | .16580 | -.02779 | -.01487 | .01628 | .21414 | .18611 | 52 |
| 53 | 19.04234 | 8.06080 | -.26778 | .25370 | -.10654 | .16671 | -.03637 | -.03068 | .00918 | .21308 | .18599 | 53 |
| 54 | 19.99672 | 8.06080 | -.26778 | .24474 | -.10135 | .16810 | -.02774 | -.03081 | .00042 | .20270 | .17377 | 54 |
| 55 | 20.95110 | 8.06080 | -.26778 | .27854 | -.10720 | .17710 | -.05652 | -.07114 | -.01094 | .21440 | .18685 | 55 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 21.90547 | 8.06080 | -.26778 | .27076 | -.09816 | .16846 | -.07116 | -.09661 | -.02204 | .19631 | .17580 | 56 |
| 57 | 22.85985 | 8.06080 | -.26778 | .25216 | -.08391 | .15628 | -.08489 | -.12079 | -.03274 | .16783 | .15528 | 57 |
| 58 | 23.81422 | 8.06080 | -.26778 | .21905 | -.06043 | .14412 | -.08802 | -.13398 | -.04305 | .12086 | .11219 | 58 |
| 59 | 24.76860 | 8.06080 | -.26778 | .19114 | -.04220 | .13482 | -.08298 | -.13863 | -.05292 | .08441 | .07635 | 59 |
| 60 | 25.72298 | 8.06080 | -.26778 | .16992 | -.02792 | .12827 | -.07224 | -.13729 | -.06246 | .05583 | .04663 | 60 |
| 61 | 19.32349 | 9.53094 | -.23740 | .28724 | -.04627 | .07522 | -.01774 | .02787 | .04720 | .09255 | .08799 | 61 |
| 62 | 20.11821 | 9.53094 | -.23740 | .27943 | -.10486 | .15712 | -.02094 | -.00797 | .01628 | .20972 | .18435 | 62 |
| 63 | 20.91292 | 9.53094 | -.23740 | .26586 | -.10985 | .16115 | -.03259 | -.02682 | .00918 | .21970 | .19426 | 63 |
| 64 | 21.70764 | 9.53094 | -.23740 | .25485 | -.10016 | .15767 | -.03378 | -.03669 | .00042 | .20031 | .17637 | 64 |
| 65 | 22.50236 | 9.53094 | -.23740 | .24760 | -.08753 | .14614 | -.02845 | -.04247 | -.01094 | .17506 | .15446 | 65 |
| 66 | 23.29708 | 9.53094 | -.23740 | .24267 | -.07865 | .13737 | -.02310 | -.04806 | -.02204 | .15730 | .13891 | 66 |
| 67 | 24.09180 | 9.53094 | -.23740 | .27582 | -.09285 | .15249 | -.04326 | -.07920 | -.03274 | .18571 | .16497 | 67 |
| 68 | 24.88651 | 9.53094 | -.23740 | .26415 | -.08046 | .14059 | -.05064 | -.09664 | -.04305 | .16092 | .14529 | 68 |
| 69 | 25.68123 | 9.53094 | -.23740 | .24085 | -.06195 | .13316 | -.05413 | -.10984 | -.05292 | .12389 | .11066 | 69 |
| 70 | 26.47595 | 9.53094 | -.23740 | .21174 | -.04296 | .12431 | -.05307 | -.11813 | -.06246 | .08591 | .07448 | 70 |
| 71 | 21.46495 | 10.99792 | -.21929 | .29058 | -.03821 | .06401 | -.01034 | .03718 | .04720 | .07643 | .07284 | 71 |
| 72 | 22.12187 | 10.99792 | -.21929 | .28445 | -.10148 | .15126 | -.01350 | .00255 | .01628 | .20296 | .17885 | 72 |
| 73 | 22.77880 | 10.99792 | -.21929 | .27694 | -.11191 | .16138 | -.02682 | -.01796 | .00918 | .22382 | .19688 | 73 |
| 74 | 23.43572 | 10.99792 | -.21929 | .26722 | -.10185 | .15203 | -.03146 | -.03088 | .00042 | .20371 | .18085 | 74 |
| 75 | 24.09265 | 10.99792 | -.21929 | .25865 | -.08892 | .14505 | -.03130 | -.04209 | -.01094 | .17785 | .15738 | 75 |
| 76 | 24.74957 | 10.99792 | -.21929 | .25202 | -.07795 | .13543 | -.02941 | -.05122 | -.02204 | .15589 | .13825 | 76 |
| 77 | 25.40649 | 10.99792 | -.21929 | .24731 | -.06994 | .12819 | -.02189 | -.05427 | -.03274 | .13987 | .12364 | 77 |
| 78 | 26.06342 | 10.99792 | -.21929 | .24373 | -.06490 | .12437 | -.01592 | -.05935 | -.04305 | .12980 | .11428 | 78 |
| 79 | 26.72034 | 10.99792 | -.21929 | .26874 | -.07211 | .12956 | -.02915 | -.08247 | -.05292 | .14421 | .12821 | 79 |
| 80 | 27.37726 | 10.99792 | -.21929 | .25832 | -.05954 | .12730 | -.03189 | -.09474 | -.06246 | .11908 | .10376 | 80 |
| 81 | 23.59645 | 12.46176 | -.22337 | .29723 | -.03196 | .05791 | -.00078 | .04737 | .04720 | .06393 | .06086 | 81 |
| 82 | 24.12201 | 12.46176 | -.22337 | .28652 | -.09660 | .14587 | -.00169 | .01614 | .01628 | .19320 | .17065 | 82 |
| 83 | 24.64757 | 12.46176 | -.22337 | .28361 | -.11076 | .16050 | -.01464 | -.00384 | .00918 | .22153 | .19371 | 83 |
| 84 | 25.17312 | 12.46176 | -.22337 | .27853 | -.10548 | .14976 | -.02120 | -.01920 | .00042 | .21096 | .18772 | 84 |
| 85 | 25.69868 | 12.46176 | -.22337 | .27156 | -.09023 | .15129 | -.02321 | -.03234 | -.01094 | .18047 | .15674 | 85 |
| 86 | 26.22424 | 12.46176 | -.22337 | .26483 | -.07428 | .14281 | -.02533 | -.04565 | -.02204 | .14856 | .12787 | 86 |
| 87 | 26.74980 | 12.46176 | -.22337 | .25893 | -.06426 | .13657 | -.02534 | -.05637 | -.03274 | .12851 | .10974 | 87 |
| 88 | 27.27535 | 12.46176 | -.22337 | .25398 | -.05641 | .13107 | -.02342 | -.06476 | -.04305 | .11283 | .09551 | 88 |
| 89 | 27.80091 | 12.46176 | -.22337 | .25023 | -.05347 | .13068 | -.02108 | -.07282 | -.05292 | .10695 | .08960 | 89 |
| 90 | 28.32647 | 12.46176 | -.22337 | .24695 | -.04547 | .12308 | -.01589 | -.07723 | -.06246 | .09094 | .07542 | 90 |
| 91 | 26.04995 | 13.88143 | -.19751 | .29079 | -.05554 | .16107 | .11873 | .15638 | .04720 | .11109 | .09591 | 91 |
| 92 | 26.40638 | 13.88143 | -.19751 | .28673 | -.09340 | .22294 | .09531 | .09926 | .01628 | .18679 | .13637 | 92 |
| 93 | 26.76280 | 13.88143 | -.19751 | .28503 | -.09793 | .22523 | .06804 | .06457 | .00918 | .19585 | .13983 | 93 |
| 94 | 27.11923 | 13.88143 | -.19751 | .28270 | -.09403 | .21339 | .05191 | .03998 | .00042 | .18805 | .13703 | 94 |
| 95 | 27.47565 | 13.88143 | -.19751 | .27977 | -.09078 | .20237 | .04329 | .02014 | -.01094 | .18156 | .13563 | 95 |
| 96 | 27.83208 | 13.88143 | -.19751 | .27568 | -.08167 | .18460 | .03745 | .00368 | -.02204 | .16334 | .12564 | 96 |
| 97 | 28.18851 | 13.88143 | -.19751 | .27147 | -.07554 | .17122 | .03390 | -.01025 | -.03274 | .15108 | .11900 | 97 |
| 98 | 28.54493 | 13.88143 | -.19751 | .26734 | -.06777 | .16212 | .03237 | -.02200 | -.04305 | .13555 | .10708 | 98 |
| 99 | 28.90136 | 13.88143 | -.19751 | .26332 | -.05473 | .16387 | .02864 | -.03602 | -.05292 | .10945 | .08051 | 99 |
| 100 | 29.25778 | 13.88143 | -.19751 | .25975 | -.04867 | .15875 | .02244 | -.04800 | -.06246 | .09734 | .07055 | 100 |

SC3 DEMO  WING ALONE FOR COMBINED ANALYSIS DESIGN-CRAIDON GEOMETRY
AERO SECTION - DEMO WING - BASIC L.E.

SPANWISE PRESSURE DISTRIBUTION

ON THE WING LOWER SURFACE

JSTN= 1    X(JST)=  15.50000

| JQ | Y | ETA | CP | CPSTR |
|---|---|---|---|---|
| 1 | .71924 | .09554 | .05761 | .12285 |
| 2 | 2.18669 | .29045 | .12365 | .10761 |
| 3 | 3.65360 | .48530 | .20987 | .16396 |
| 4 | 5.12063 | .68016 | .25746 | .24243 |
| 5 | 6.58965 | .87528 | .19524 | .16700 |

JSTN= 2    X(JST)=  19.90000

| JQ | Y | ETA | CP | CPSTR |
|---|---|---|---|---|
| 1 | .71924 | .06925 | .01320 | .03301 |
| 2 | 2.18669 | .21054 | .05483 | .04147 |
| 3 | 3.65360 | .35178 | .08514 | .06823 |
| 4 | 5.12063 | .49303 | .10129 | .11881 |
| 5 | 6.58965 | .63448 | .18978 | .16945 |
| 6 | 8.06080 | .77612 | .20375 | .17501 |
| 7 | 9.53094 | .91767 | .17755 | .15789 |

JSTN= 3    X(JST)=  24.40000

| JQ | Y | ETA | CP | CPSTR |
|---|---|---|---|---|
| 1 | 3.65360 | .27454 | .04319 | .02768 |
| 2 | 5.12063 | .38477 | .01859 | .00992 |
| 3 | 6.58965 | .49515 | .05445 | .04371 |
| 4 | 8.06080 | .60570 | .09849 | .09019 |
| 5 | 9.53094 | .71616 | .17610 | .15734 |
| 6 | 10.99792 | .82640 | .16758 | .14843 |
| 7 | 12.46176 | .93639 | .20818 | .18285 |

SC3 DEMO WING ALONE FOR COMBINED ANALYSIS DESIGN-CRAIDON GEOMETRY
AERO SECTION - DEMO WING - BASIC L.E.

INTEGRATION OF THE PRESSURE DISTRIBUTION

ON THE WING LOWER SURFACE

MACH= 1.6200 ALPHA= 0.0000

| POINT | X | Y | Z | X/C | 2Y/B | Z/C | CP | CPSTR | POINT |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.66425 | .71924 | -.12803 | .05000 | .04894 | 0.00000 | .00833 | .00661 | 1 |
| 2 | 4.90849 | .71924 | -.12803 | .15000 | .04894 | 0.00000 | .28344 | .29529 | 2 |
| 3 | 7.15274 | .71924 | -.12803 | .25000 | .04894 | 0.00000 | .36645 | .42450 | 3 |
| 4 | 9.39699 | .71924 | -.12803 | .35000 | .04894 | 0.00000 | .29728 | .41696 | 4 |
| 5 | 11.64123 | .71924 | -.12803 | .45000 | .04894 | 0.00000 | .15003 | .25517 | 5 |
| 6 | 13.88548 | .71924 | -.12803 | .55000 | .04894 | 0.00000 | .06729 | .14053 | 6 |
| 7 | 16.12973 | .71924 | -.12803 | .65000 | .04894 | .00000 | .03136 | .07490 | 7 |
| 8 | 18.37397 | .71924 | -.12803 | .75000 | .04894 | 0.00000 | .01721 | .04113 | 8 |
| 9 | 20.61822 | .71924 | -.12803 | .85000 | .04894 | 0.00000 | -.00021 | .00585 | 9 |
| 10 | 22.86247 | .71924 | -.12803 | .95000 | .04894 | 0.00000 | -.01104 | -.01651 | 10 |
| 11 | 5.66629 | 2.18669 | -.30771 | .05000 | .14878 | 0.00000 | -.03909 | -.03706 | 11 |
| 12 | 7.62558 | 2.18669 | -.30771 | .15000 | .14878 | -.00000 | .22873 | .18721 | 12 |
| 13 | 9.58487 | 2.18669 | -.30771 | .25000 | .14878 | 0.00000 | .28021 | .22026 | 13 |
| 14 | 11.54416 | 2.18669 | -.30771 | .35000 | .14878 | -.00000 | .26101 | .21708 | 14 |
| 15 | 13.50344 | 2.18669 | -.30771 | .45000 | .14878 | 0.00000 | .15381 | .13374 | 15 |
| 16 | 15.46273 | 2.18669 | -.30771 | .55000 | .14878 | -.00000 | .10080 | .08782 | 16 |
| 17 | 17.42202 | 2.18669 | -.30771 | .65000 | .14878 | 0.00000 | .07187 | .05932 | 17 |
| 18 | 19.38131 | 2.18669 | -.30771 | .75000 | .14878 | -.00000 | .05096 | .03741 | 18 |
| 19 | 21.34059 | 2.18669 | -.30771 | .85000 | .14878 | 0.00000 | .04493 | .03148 | 19 |
| 20 | 23.29988 | 2.18669 | -.30771 | .95000 | .14878 | -.00000 | .02998 | .01583 | 20 |
| 21 | 8.65191 | 3.65360 | -.35459 | .05000 | .24859 | 0.00000 | -.07256 | -.06578 | 21 |
| 22 | 10.32810 | 3.65360 | -.35459 | .15000 | .24859 | 0.00000 | .22712 | .18001 | 22 |
| 23 | 12.00430 | 3.65360 | -.35459 | .25000 | .24859 | 0.00000 | .26752 | .19336 | 23 |
| 24 | 13.68049 | 3.65360 | -.35459 | .35000 | .24859 | 0.00000 | .27481 | .20417 | 24 |
| 25 | 15.35669 | 3.65360 | -.35459 | .45000 | .24859 | 0.00000 | .17262 | .14089 | 25 |
| 26 | 17.03289 | 3.65360 | -.35459 | .55000 | .24859 | 0.00000 | .12385 | .10189 | 26 |
| 27 | 18.70908 | 3.65360 | -.35459 | .65000 | .24859 | 0.00000 | .09149 | .07429 | 27 |
| 28 | 20.38528 | 3.65360 | -.35459 | .75000 | .24859 | 0.00000 | .06712 | .05104 | 28 |
| 29 | 22.06147 | 3.65360 | -.35459 | .85000 | .24859 | -.00000 | .05351 | .03766 | 29 |
| 30 | 23.73767 | 3.65360 | -.35459 | .95000 | .24859 | 0.00000 | .04259 | .02710 | 30 |
| 31 | 11.56043 | 5.12063 | -.33054 | .05000 | .34841 | 0.00000 | .18548 | .19160 | 31 |
| 32 | 12.96279 | 5.12063 | -.33054 | .15000 | .34841 | 0.00000 | .22167 | .20528 | 32 |
| 33 | 14.36514 | 5.12063 | -.33054 | .25000 | .34841 | 0.00000 | .25903 | .23965 | 33 |
| 34 | 15.76750 | 5.12063 | -.33054 | .35000 | .34841 | .00000 | .25467 | .24738 | 34 |
| 35 | 17.16986 | 5.12063 | -.33054 | .45000 | .34841 | 0.00000 | .16849 | .18864 | 35 |
| 36 | 18.57221 | 5.12063 | -.33054 | .55000 | .34841 | 0.00000 | .12157 | .14309 | 36 |
| 37 | 19.97457 | 5.12063 | -.33054 | .65000 | .34841 | 0.00000 | .08074 | .09422 | 37 |
| 38 | 21.37693 | 5.12063 | -.33054 | .75000 | .34841 | 0.00000 | .05388 | .05903 | 38 |
| 39 | 22.77928 | 5.12063 | -.33054 | .85000 | .34841 | 0.00000 | .02697 | .02320 | 39 |
| 40 | 24.18164 | 5.12063 | -.33054 | .95000 | .34841 | 0.00000 | .01510 | .00439 | 40 |
| 41 | 14.26633 | 6.58965 | -.29483 | .05000 | .44837 | 0.00000 | .15626 | .13987 | 41 |
| 42 | 15.42217 | 6.58965 | -.29483 | .15000 | .44837 | 0.00000 | .21940 | .18382 | 42 |
| 43 | 16.57801 | 6.58965 | -.29483 | .25000 | .44837 | 0.00000 | .20949 | .17425 | 43 |
| 44 | 17.73385 | 6.58965 | -.29483 | .35000 | .44837 | 0.00000 | .24374 | .19869 | 44 |
| 45 | 18.88969 | 6.58965 | -.29483 | .45000 | .44837 | 0.00000 | .20504 | .17937 | 45 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 46 | 20.04553 | 6.58965 | -.29483 | .55000 | .44837 | 0.00000 | .16907 | .15597 | 46 |
| 47 | 21.20137 | 6.58965 | -.29483 | .65000 | .44837 | 0.00000 | .12072 | .11213 | 47 |
| 48 | 22.35721 | 6.58965 | -.29483 | .75000 | .44837 | 0.00000 | .08447 | .07564 | 48 |
| 49 | 23.51305 | 6.58965 | -.29483 | .85000 | .44837 | 0.00000 | .06202 | .05188 | 49 |
| 50 | 24.66889 | 6.58965 | -.29483 | .95000 | .44837 | 0.00000 | .03815 | .02615 | 50 |
| 51 | 16.70412 | 8.06080 | -.26778 | .05000 | .54847 | 0.00000 | .12135 | .11320 | 51 |
| 52 | 17.65850 | 8.06080 | -.26778 | .15000 | .54847 | 0.00000 | .21414 | .18611 | 52 |
| 53 | 18.61287 | 8.06080 | -.26778 | .25000 | .54847 | 0.00000 | .21308 | .18599 | 53 |
| 54 | 19.56725 | 8.06080 | -.26778 | .35000 | .54847 | 0.00000 | .20270 | .17377 | 54 |
| 55 | 20.52163 | 8.06080 | -.26778 | .45000 | .54847 | 0.00000 | .21440 | .18685 | 55 |
| 56 | 21.47600 | 8.06080 | -.26778 | .55000 | .54847 | 0.00000 | .19631 | .17580 | 56 |
| 57 | 22.43038 | 8.06080 | -.26778 | .65000 | .54847 | 0.00000 | .16783 | .15528 | 57 |
| 58 | 23.38475 | 8.06080 | -.26778 | .75000 | .54847 | 0.00000 | .12086 | .11219 | 58 |
| 59 | 24.33913 | 8.06080 | -.26778 | .85000 | .54847 | 0.00000 | .08441 | .07635 | 59 |
| 60 | 25.29351 | 8.06080 | -.26778 | .95000 | .54847 | 0.00000 | .05583 | .04663 | 60 |
| 61 | 18.96586 | 9.53094 | -.23740 | .05000 | .64850 | 0.00000 | .09255 | .08799 | 61 |
| 62 | 19.76058 | 9.53094 | -.23740 | .15000 | .64850 | -.00000 | .20972 | .18435 | 62 |
| 63 | 20.55530 | 9.53094 | -.23740 | .25000 | .64850 | -.00000 | .21970 | .19426 | 63 |
| 64 | 21.35002 | 9.53094 | -.23740 | .35000 | .64850 | .00000 | .20031 | .17637 | 64 |
| 65 | 22.14474 | 9.53094 | -.23740 | .45000 | .64850 | -.00000 | .17506 | .15446 | 65 |
| 66 | 22.93945 | 9.53094 | -.23740 | .55000 | .64850 | -.00000 | .15730 | .13891 | 66 |
| 67 | 23.73417 | 9.53094 | -.23740 | .65000 | .64850 | -.00000 | .18571 | .16497 | 67 |
| 68 | 24.52889 | 9.53094 | -.23740 | .75000 | .64850 | 0.00000 | .16092 | .14529 | 68 |
| 69 | 25.32361 | 9.53094 | -.23740 | .85000 | .64850 | -.00000 | .12389 | .11066 | 69 |
| 70 | 26.11833 | 9.53094 | -.23740 | .95000 | .64850 | -.00000 | .08591 | .07448 | 70 |
| 71 | 21.16934 | 10.99792 | -.21929 | .05000 | .74831 | 0.00000 | .07643 | .07284 | 71 |
| 72 | 21.82626 | 10.99792 | -.21929 | .15000 | .74831 | 0.00000 | .20296 | .17885 | 72 |
| 73 | 22.48318 | 10.99792 | -.21929 | .25000 | .74831 | 0.00000 | .22382 | .19688 | 73 |
| 74 | 23.14011 | 10.99792 | -.21929 | .35000 | .74831 | 0.00000 | .20371 | .18085 | 74 |
| 75 | 23.79703 | 10.99792 | -.21929 | .45000 | .74831 | 0.00000 | .17785 | .15738 | 75 |
| 76 | 24.45395 | 10.99792 | -.21929 | .55000 | .74831 | 0.00000 | .15589 | .13825 | 76 |
| 77 | 25.11088 | 10.99792 | -.21929 | .65000 | .74831 | 0.00000 | .13987 | .12364 | 77 |
| 78 | 25.76780 | 10.99792 | -.21929 | .75000 | .74831 | 0.00000 | .12980 | .11428 | 78 |
| 79 | 26.42473 | 10.99792 | -.21929 | .85000 | .74831 | 0.00000 | .14421 | .12821 | 79 |
| 80 | 27.08165 | 10.99792 | -.21929 | .95000 | .74831 | 0.00000 | .11908 | .10376 | 80 |
| 81 | 23.35995 | 12.46176 | -.22337 | .05000 | .84791 | 0.00000 | .06393 | .06086 | 81 |
| 82 | 23.88551 | 12.46176 | -.22337 | .15000 | .84791 | 0.00000 | .19320 | .17065 | 82 |
| 83 | 24.41107 | 12.46176 | -.22337 | .25000 | .84791 | 0.00000 | .22153 | .19371 | 83 |
| 84 | 24.93662 | 12.46176 | -.22337 | .35000 | .84791 | 0.00000 | .21096 | .18772 | 84 |
| 85 | 25.46218 | 12.46176 | -.22337 | .45000 | .84791 | 0.00000 | .18047 | .15674 | 85 |
| 86 | 25.98774 | 12.46176 | -.22337 | .55000 | .84791 | 0.00000 | .14856 | .12787 | 86 |
| 87 | 26.51330 | 12.46176 | -.22337 | .65000 | .84791 | 0.00000 | .12851 | .10974 | 87 |
| 88 | 27.03885 | 12.46176 | -.22337 | .75000 | .84791 | 0.00000 | .11283 | .09551 | 88 |
| 89 | 27.56441 | 12.46176 | -.22337 | .85000 | .84791 | 0.00000 | .10695 | .08960 | 89 |
| 90 | 28.08997 | 12.46176 | -.22337 | .95000 | .84791 | 0.00000 | .09094 | .07542 | 90 |
| 91 | 25.88956 | 13.88143 | -.19751 | .05000 | .94451 | 0.00000 | .11109 | .09591 | 91 |
| 92 | 26.24598 | 13.88143 | -.19751 | .15000 | .94451 | .00000 | .18679 | .13637 | 92 |
| 93 | 26.60241 | 13.88143 | -.19751 | .25000 | .94451 | .00000 | .19585 | .13983 | 93 |
| 94 | 26.95884 | 13.88143 | -.19751 | .35000 | .94451 | .00000 | .18805 | .13703 | 94 |
| 95 | 27.31526 | 13.88143 | -.19751 | .45000 | .94451 | .00000 | .18156 | .13563 | 95 |
| 96 | 27.67169 | 13.88143 | -.19751 | .55000 | .94451 | .00000 | .16334 | .12564 | 96 |
| 97 | 28.02811 | 13.88143 | -.19751 | .65000 | .94451 | 0.00000 | .15108 | .11900 | 97 |
| 98 | 28.38454 | 13.88143 | -.19751 | .75000 | .94451 | .00000 | .13555 | .10708 | 98 |
| 99 | 28.74097 | 13.88143 | -.19751 | .85000 | .94451 | .00000 | .10945 | .08051 | 99 |
| 100 | 29.09739 | 13.88143 | -.19751 | .95000 | .94451 | .00000 | .09734 | .07055 | 100 |

```
TOTAL COEFFICIENTS
------------------
ON THE WING
```

INPUT REFERENCE AREA

NOTE: REFERENCE AREA IS 1/2 TOTAL PLANFORM AREA, CONSISTENT WITH WOODWARD I PRACTICE.

```
REFA=      171.0500   REFB=       14.6970   REFC=       14.7470

REFX=       16.7010   REFZ=        0.0000

  MACH=     1.62000
 ALPHA=     0.00000
    CN=      .40000
    CA=      .04401
    CM=    -.03583
    CL=      .40000
    CD=      .04401
   XCP=      .08958

  CDCL=      .21579
```

$\frac{\Delta C_D}{\beta C_L^2}$

```
  BASED ON THE CARLSON CORRECTION

  MACH=     1.62000
 ALPHA=     0.00000
    CN=      .36941
    CA=      .04109
    CM=    -.03109
    CL=      .36941
    CD=      .04109
   XCP=      .08415

  CDCL=      .23623

  AREA=   172.34067    (TOTAL-AREA)
```

INTERNALLY COMPUTED PLANFORM AREA

```
  AREA=   118.97679    (EXPOSED-AREA)
```

MEANS PANELS WHERE PRESSURES <u>ARE NOT</u> SPECIFIED

```
   CNF=      .26123    (EXPOSED-LIFT)

   CDF=      .04407    (EXPOSED-DRAG)

 CDFCL=      .21611    (EXPOSED DRAG-TOTAL LIFT)

  BASED ON THE CARLSON CORRECTION

   CNF=      .24125    (EXPOSED-LIFT)

   CDF=      .04056    (EXPOSED-DRAG)

 CDFCL=      .23322    (EXPOSED DRAG-TOTAL LIFT)
```

SECTION COEFFICIENTS (BASIC SPANWISE DISTRIBUTIONS USING STANDARD PRESSURES)

ON THE WING

| K | Y | ETA | C/CAVE | C*CL/CAVE | C*CD/CAVE | CN | CA | CL | CD | CM | XCP | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .71924 | .04894 | 1.92831 | .56288 | .17495 | .29191 | .09073 | .29191 | .09073 | .11669 | -.39974 | 1 |
| 2 | 2.18669 | .14878 | 1.68346 | .53732 | .05967 | .31918 | .03545 | .31918 | .03545 | .06065 | -.19002 | 2 |
| 3 | 3.65360 | .24859 | 1.44023 | .51090 | .03656 | .35473 | .02538 | .35473 | .02538 | .02043 | -.05760 | 3 |
| 4 | 5.12063 | .34841 | 1.20494 | .48463 | .08278 | .40221 | .06870 | .40221 | .06870 | .00172 | -.00427 | 4 |
| 5 | 6.58965 | .44837 | .99312 | .44259 | .03565 | .44565 | .03590 | .44565 | .03590 | -.06408 | .14379 | 5 |
| 6 | 8.06080 | .54847 | .82002 | .39818 | .02467 | .48558 | .03008 | .48558 | .03008 | -.13078 | .26932 | 6 |
| 7 | 9.53094 | .64850 | .68284 | .34998 | .01498 | .51254 | .02193 | .51254 | .02193 | -.19853 | .38734 | 7 |
| 8 | 10.99792 | .74831 | .56444 | .29790 | .00874 | .52778 | .01548 | .52778 | .01548 | -.26314 | .49857 | 8 |
| 9 | 12.46176 | .84791 | .45157 | .24188 | .00499 | .53565 | .01106 | .53565 | .01106 | -.32468 | .60614 | 9 |
| 10 | 13.88143 | .94451 | .30625 | .16309 | -.00585 | .53255 | -.01911 | .53255 | -.01911 | -.38816 | .72887 | 10 |

SECTION COEFFICIENTS

ON THE WING

BASED ON THE CARLSON CORRECTION

| K | Y | ETA | C/CAVE | C*CL/CAVE | C*CD/CAVE | CN | CA | CL | CD | CM | XCP | K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .71924 | .04894 | 1.92831 | .50736 | .15794 | .26311 | .08191 | .26311 | .08191 | .11813 | -.44897 | 1 |
| 2 | 2.18669 | .14878 | 1.68346 | .48417 | .05553 | .28761 | .03298 | .28761 | .03298 | .05516 | -.19181 | 2 |
| 3 | 3.65360 | .24859 | 1.44023 | .46222 | .03559 | .32094 | .02471 | .32094 | .02471 | .01645 | -.05126 | 3 |
| 4 | 5.12063 | .34841 | 1.20494 | .47797 | .08123 | .39668 | .06741 | .39668 | .06741 | .00368 | -.00928 | 4 |
| 5 | 6.58965 | .44837 | .99312 | .41643 | .03328 | .41932 | .03351 | .41932 | .03351 | -.05992 | .14291 | 5 |
| 6 | 8.06080 | .54847 | .82002 | .36967 | .02287 | .45080 | .02788 | .45080 | .02788 | -.12102 | .26847 | 6 |
| 7 | 9.53094 | .64850 | .68284 | .32218 | .01394 | .47182 | .02041 | .47182 | .02041 | -.18235 | .38648 | 7 |
| 8 | 10.99792 | .74831 | .56444 | .27294 | .00826 | .48355 | .01463 | .48355 | .01463 | -.24084 | .49806 | 8 |
| 9 | 12.46176 | .84791 | .45157 | .21843 | .00474 | .48372 | .01049 | .48372 | .01049 | -.29287 | .60546 | 9 |
| 10 | 13.88143 | .94451 | .30625 | .15311 | -.00515 | .49996 | -.01682 | .49996 | -.01682 | -.36491 | .72988 | 10 |

CPSTAG = 1.83906 CPCRIT = .71476 CPVAC = -.54434

SOLVE, TIME = 261.32300

SOLVE, TIME = 261.32300

## CONCLUSIONS

The two computer programs described in this report provide the aerodynamicist with a very powerful and flexible capability to do supersonic wing design. In particular, the flowfield in the vicinity of the leading edge can be analyzed in more detail using COREL due to the spanwise section mapping which, together with the complete full potential equation, eliminates the leading edge singularity and provides for the explicit treatment of the supercritical crossflow. The W12SC3 code offers many linear theory wing design and analysis options and can be used for investigating the impact of $SC^3$ wing design on total configuration characteristics.

Grumman Aerospace Corporation

Bethpage, New York 11714

October 14, 1983

# REFERENCES


1. Miller, D.S., Carlson, H.W., and Middleton, W.D., "A Linearized Theory Method of Constrained Optimization for Supersonic Cruise Wing Design," Proc. of the SCAR Conf., NASA CP-001, November 1976.

2. Mason, W.H., and Miller, D.S., "Controlled Supercritical Crossflow on Supersonic Wings - An Experimental Validation," AIAA Paper No. 80-1421, July, 1980.

3. Mason, W.H., and DaForno, G., "Opportunities for Supersonic Performance Gains Through Non-Linear Aerodynamics," AIAA Paper No. 79-1527, July 1979.

4. Grossman, B., "A Numerical Procedure for the Computation of Supersonic Conical Flows," AIAA J., Vol. 17, No. 8, Aug. 1979, pp. 828-837.

5. Woodward, F.A., "An Improved Method for the Aerodynamic Analysis of Wing-Body-Tail Configurations in Subsonic and Supersonic Flow," NASA CR-2228, Parts I and II, 1973.

6. Craidon, C.B., "A Computer Program for Fitting Smooth Surfaces to an Aircraft Configuration and Other Three-Dimensional Geometries," NASA TM X-3206, 1975.

7. Siclari, M.J., and Marconi F., "Analysis and Design of Supersonic Aircraft Based on Inviscid Nonlinear Eulerian Equations," Part I, Rotational Euler Solutions with Explicit Shock Fitting, AFWAL TR-80-3110, October 1980, pp. 53-56.

8. Woodward, F.A., "USSAERO Computer Program Development, Versions B and C," NASA CR-3227, 1980.

9. Woodward, F.A., Tinoco, E.N., and Larsen, J.W., "Analysis and Design of Supersonic Wing-Body Combinations, Including Flow Properties in the Near Field," Part I - Theory and Application, NASA CR-73106, 1967.

10. Cenko, A., "Advances in Supersonic Configuration Design Methods," Journal of Aircraft, Vol. 17, No. 2, Feb. 1980, pp. 119-126.

11. Carlson, H.W., "A Modification to Linearized Theory for Prediction of Pressure Loadings on Lifting Surfaces at High Supersonic Mach Numbers and Large Angles of Attack," NASA TP-1406, 1979.

12. Craidon, C.B., "Description of a Digital Computer Program for Airplane Configuration Plots," NASA TM X-2074, 1970.

13. Miller, D.S., Landrum, E.J., Townsend, J.C., and Mason, W.H., "Pressure and Force Data for a Flat Wing and a Warped Conical Wing Having a Shockless Recompression at Mach 1.62", NASA TP-1759, 1981.

14. Siclari, M.J., and Grossman, B., "Analysis and Design of Supersonic Aircraft Based on Inviscid Nonlinear Eulerian Equations", Part II, Nonlinear Potential Flow Solutions with Shock Capturing, AFWAL TR-80-3110, October 1980.

15. Mason, W.H., "Experimental Pressure Distributions and Aerodynamic Characteristics of a Demonstration Wing for a Wing Concept for Supersonic Maneuvering", Grumman Aerodynamics Report 393-82-02, July 1982. (Available from the author upon request.)

16. Grossman, B., and Siclari, M.J., "The Nonlinear Supersonic Potential Flow over Delta Wings", AIAA Paper No. 80-0269, January 1980.

17. Mason, W.H., "Experimental Pressure Distributions and Aerodynamic Characteristics of Flat and Cambered Conceptual Wing-Body and Wing-Body-Canard", Grumman Aerodynamics Report 393-81-1, October 1981. (Available from the author upon request.)

18. Harris, R.V., Jr., "An Analysis and Correlation of Aircraft Wave Drag", NASA TM X-947, 1964.

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15. Supplementary Notes

Langley Technical Monitor: David S. Miller
Final Report

16. Abstract

This report contains a description of two computer codes useful in the supersonic aerodynamic design of wings, including the supersonic maneuver case. The non-linear full potential equation COREL code performs an analysis of a spanwise section of the wing in the crossflow plane by assuming conical flow over the section. A subsequent approximate correction to the solution can be made in order to account for nonconical effects. In COREL, the flow-field is assumed to be irrotional (Mach numbers normal to shock waves less than about 1.3) and the full potential equation is solved to obtain detailed results for the leading edge expansion, supercritical crossflow, and any crossflow shockwaves. W12SC3 is a linear theory panel method which combines and extends elements of several of Woodward's codes, with emphasis on fighter applications. After a brief review of the aerodynamic theory used by each method, the use of the codes is illustrated with several examples, detailed input instructions and a sample case.

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